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In Reply Refer To:
AESO/SE
02-21-05-F-0495

January 23, 2006

Memorandum

To: Refuge Manager, San Bernardino and Leslie Canyon National Wildlife Refuges, Douglas, Arizona

From: Field Supervisor

Subject: Biological Opinion for the Implementation of the Fire Management Plan at San Bernardino and Leslie Canyon National Wildlife Refuges

Thank you for your request for formal consultation with the Arizona Ecological Services Office (AESO) pursuant to section 7 of the Endangered Species Act of 1973 (16 U.S.C. 1531-1544), as amended (Act). Your request was dated May 11, 2005 and received by us on May 12, 2005. We received additional maps on June 29, 2005. At issue are impacts that may result from the proposed Fire Management Plan for the San Bernardino and Leslie Canyon National Wildlife Refuges (NWRs or Refuges) located in Cochise County, Arizona on the Yaqui topminnow (*Poeciliopsis occidentalis sonoriensis*), Yaqui Chub (*Gila purpurea*), Yaqui catfish (*Ictalurus pricei*), beautiful shiner (*Cyprinella formosa*), Chiricahua leopard frog (*Rana chiricahuensis*), Huachuca water umbel (*Lilaeopsis schaffneriana* var. *recurva*), and critical habitat for the Yaqui chub, Yaqui catfish, and beautiful shiner.

This biological opinion is based on information provided in the May 11, 2005 Intra-Service Section 7 Biological Evaluation Form, the 2005 Fire Management Plan, field investigations, e-mails, and other sources of information. Literature cited in this biological opinion is not a complete bibliography of all literature available on the species of concern, fire management and its effects, or on other subjects considered in this opinion. A complete administrative record of this consultation is on file at the AESO, Phoenix, Arizona. We encourage you to coordinate your review of this opinion with the Arizona Game and Fish Department.

CONSULTATION HISTORY

May 11, 2005: Request for formal consultation and Fire Management Plan sent to us.

May 24, 2005: Request for formal consultation received by the Tucson Ecological Services Office.

July 27, 2005: Field trip to Leslie Creek and San Bernardino NWRs to view and discuss the project.

December 19, 2005: Date of Draft Biological Opinion.

January 11, 2006: Comments received from Refuge Manager regarding Draft Biological Opinion.

January 23, 2006: Date of Final Biological Opinion.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

San Bernardino and Leslie Canyon NWRs are located in southeastern Arizona's Cochise County. The San Bernardino NWR is located adjacent to the Republic of Mexico, 16 miles east of Douglas along Geronimo Trail Road. Leslie Canyon NWR is located on the edge of the Swisshelm Mountains, 16 miles north of Douglas on Leslie Canyon Road.

The 2,369-acre San Bernardino NWR and the 2,765-acre Leslie Canyon NWR lie within the Río Yaqui River Basin, a major river system that drains parts of Cochise County, Hidalgo County, New Mexico, western Chihuahua, and eastern Sonora. The primary role of the two Refuges is the sustainability and recovery of native threatened and endangered fish in the Río Yaqui Basin.

The proposed action entails the implementation of a Fire Management Plan (FMP) potentially involving the entire acreage of both the San Bernardino and Leslie Canyon NWRs. The goal of the FMP is to return fire as an integral, natural process in the maintenance of the Refuges' ecosystems, and, ultimately, to provide an overall benefit to each of the Federally-listed threatened and endangered species undergoing population recovery. This will largely be accomplished by excluding fire from some areas, removing volatile fuels prior to burning, and carefully selecting the season and conditions under which to perform prescribed burning. Due to historical soil loss and woody species encroachment on the uplands, mechanical and herbicide treatments along with native seeding may be first required to foster grass and forb fuel continuity to carry a prescribed fire. Fire would be the secondary treatment once grasses and forbs are established. All naturally ignited wildfires will be suppressed due to the values at risk, the present unnatural fuel loading, and the limited number of Refuge staff.

Prescribed fire

Because San Bernardino and Leslie Canyon NWRs have different fire management objectives, the Fire Management Plan outlines separate Wildland Fire Management Strategies for each Refuge. Within each Refuge, Fire Management Units (FMUs) are identified by their major vegetation cover types and expected response to fire. Each FMU is defined by the fire behavior characteristics that are exhibited across the zone by current fuels and by future desired conditions. For a complete description of each FMU, see pages 38-44 of the Fire Management Plan.

The management objectives for San Bernardino NWR are to restore the native grasslands, including giant sacaton and other species; control upland brush species such as mesquite and acacia, which are invading historical grasslands; reduce emergent vegetation in Refuge wetlands; protect sensitive riparian areas from high-intensity wildland fire; and protect historical and pre-historical values on the Refuge. This Refuge is divided into FMUs 1, 2, and 3 (Figure 1). Of the FMUs on San Bernardino NWR, FMU 3 is the most sensitive, as it includes 86 acres of riparian, marshland, and aquatic areas.

The management objectives for Leslie Canyon NWR are to protect the unique Arizona black walnut/Arizona ash riparian corridor; restore native grasslands, including giant sacaton and other native species; and ensure continued propagation of key species such as agave. This Refuge is divided into FMU 4 and FMU subunits 5.1 and 5.2 (Figure 2). Subunit 5.1 will be protected from wildfire and excluded from prescribed fire activities, as this subunit includes the endangered fish management area, as well as a unique corridor of Arizona black walnut and Arizona ash. The adjacent subunit 5.2, which encompasses the giant sacaton grassland on this Refuge, may be treated with prescribed fire, mechanical treatments, or a combination of other tools, but fire will be carefully applied, as an escaped fire into the walnut/ash corridor would have direct adverse effects on this vegetation community.

Emergent vegetation in wetland ponds

A major part of the proposed action is to periodically use fire as a cost efficient mechanism for managing emergent vegetation and retarding plant succession in wetlands (FMU 3). The wetlands in which the native fish and frog species exist on San Bernardino NWR are prone to the rapid growth of emergent vegetation. The natural process of cattail growth leads to eventual succession of habitat from deep to shallow wetlands, and then to meadows, thereby eliminating the habitat necessary to support fish and tadpoles. Refuge ponds are designed for water management through the use of water control structures at pond outlets. This allows pond water levels to be lowered, or even nearly dried. During December/January, when air temperatures drop below freezing and cattail becomes dry and decadent, pond water levels can be lowered below the root stems and cattails can effectively be burned. Following the burn, water levels can be raised, and if cattail stems can be covered by 12-18 inches of water, significant cattail mortality (through drowning) occurs. This method does not eliminate emergent vegetation and the habitat structure it provides, but it does effectively ensure open water habitats for fish and frogs.

A wetland management technique designed to further avoid potential negative effects on native fish and tadpoles has been the construction of Refuge ponds as “mirror image” pairs, separated from each other by a distance of about 30 feet of upland, which provides an effective firebreak between wetlands. When emergent vegetation reaches a density where it negatively impacts native fish populations and requires control, the water level in one of the paired ponds can be slowly lowered. Slow draining concentrates the pond’s water (and the fish and tadpoles) at the deep end, allowing effective seining and temporary removal of the fish and frogs from the pond. These vertebrates can then be quickly moved into the adjacent pond while the drained pond is burned and then refilled and flushed to remove ash. Once refilled with water, the pond will again be ready for the introduction of fish and tadpoles from the adjacent pond. This is a management technique that works well in southern California without take of Yuma clapper rails, and it has been modified to work effectively with native fish and frogs in southern Arizona.

<u>Non-fire applications</u>

In addition to prescribed fire, there are opportunities to use non-fire applications in conjunction with fire applications to accomplish management and resource objectives. Non-fire tools,

including mechanical and chemical options, will be considered when exclusive fire treatments might adversely affect highly sensitive areas. Mechanical fuel treatments may include mowing areas of light vegetation, creating and maintaining fire breaks, removing or reducing heavy fuel loadings prior to reintroducing fire, and removing emergent vegetation in wetland areas. Chemical treatments may include vegetation treatments around improvements, invasive/exotic vegetation treatments on the uplands, mechanical/chemical treatments of native woody species in undesirable areas, and wetland treatments to assist in the control of emergent vegetation.

Wildfire suppression

Naturally ignited wildfires occurring within the San Bernardino/Leslie Canyon NWRs will be suppressed as quickly and safely as possible. The range of appropriate management responses may include lower fire intensity direct attack efforts (Leslie Canyon only) or high fire intensity indirect efforts. Naturally ignited wildfires in FMUs 1 and 2 primarily will be suppressed using indirect attack methods. Natural and improved barriers such as roads, areas devoid of vegetation, previously burned blocks, and fire breaks will be used as much as possible. Direct attack is the preferred suppression response in FMUs 3 and 5 if suppression tactics can be safely implemented. Direct or indirect suppression responses in FMU 4 will be evaluated and implemented, considering safety as the number one priority.

Conservation Measures

- Prescribed burns in wetlands will be timed to occur during the cool season (December-January). During this time period, air and water temperatures are low and dissolved oxygen levels are high so fish are least likely to be negatively impacted; amphibians are dormant under mud or in the water and are not likely to seek escape cover in vegetation adjacent to shorelines, so leopard frogs are least likely to be negatively impacted; and vegetation is dormant with energy reserves concentrated in rhizomes so water umbel is least likely to be negatively impacted. This action will greatly reduce any potential adverse effects on the fish, leopard frog, and umbel and will assist in the recovery efforts for these species.

- When managed Refuge ponds are selectively lowered or drained to allow removal (through seining) of large numbers of fish and tadpoles, non-native species (such as bullfrogs) will be opportunistically eliminated. This action will greatly reduce potential adverse effects upon fish and frogs and will assist in the recovery efforts for these species.

- Refuge ponds can be selectively burned on a rotational basis to control emergent vegetation so that in any given year there are always a large number of undisturbed wetlands populated by fish and frogs that are not being impacted in any manner. Where “mirror image” ponds exist, both ponds will never be drained and burned during the same year, leaving one of the pair available to temporarily and cost efficiently hold the fish and tadpoles while the other is being managed with fire. This action will greatly reduce potential adverse effects upon fish and frogs and will assist in the recovery efforts for these species.

- The Arizona Fire District (AFD) staff is available for preparedness and planning activity assistance. Each spring, fire personnel from the AFD will consult with the refuge manager to ensure training and equipment needs are met. Preliminary preparedness planning will be completed by March 15 of each year. Contracts will be made with external fire response units including local fire departments and the Coronado National Forest to coordinate pre-suppression planning each year during annual preparedness planning and consultation. By engaging in this coordination, the Refuges reduce the risk of potential adverse effects to fish, frogs, and umbel.

- Monitoring of all fire activity on the refuges will occur annually, and burned wetlands will continue to be monitored to document potential changes in vegetation composition and abundance, to document potential water quality changes, and to document potential changes in relative abundance and mortality of fish and amphibian individuals and populations. These actions will greatly reduce potential adverse effects upon fish and frogs.

- Fuel (decadent limbs, wood, and other vegetation) accumulations will be burned in small scale prescribed burns to eliminate the potential for a large wildfire that could burn through entire riparian corridors and greatly impact water quality through live vegetation removal, ash accumulation, and soil particle transport. This will greatly reduce potential adverse effects to fish, frogs, and umbel and will assist in the recovery efforts for these species.

- During prescribed burns and wildfire suppression, Minimum Impact Suppression Tactics (MIST) will be implemented. These tactics include, but are not limited to: using natural barriers to avoid unnecessary fire line construction, whenever possible; using protective tactics in areas identified as sensitive natural resources; prohibiting the use of heavy equipment, such as bulldozers; and prohibiting the use of fire retardant, foam agent, surfactants, explosives, or removal of water from any pond, tank, or stream. By using these tactics, adverse effects to fish, frogs, and umbel populations are greatly reduced.

- Herbicide selection and application methods will be designed to mitigate any potential effects to riparian areas and their wildlife. Strict monitoring of impacts on fish populations will be done in order to minimize adverse effects.

- Should an incident occur that calls for post-fire emergency rehabilitation (stabilization) and restoration, the Refuge will follow protocols as outlined in the Interagency Burned Area Emergency Stabilization and Rehabilitation Handbook.

STATUS OF THE SPECIES

Yaqui topminnow

Our September 3, 2004 Biological and Conference Opinion for the BLM Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management (02-21-03-F-0210)

included a detailed Status of the Species for the Yaqui topminnow. This biological opinion is available on our website at http://www.fws.gov/arizonaes, under Document Library; Section 7 Biological Opinions. Herein we incorporate that status discussion by reference.

The Yaqui topminnow is found throughout the Río Yaqui and adjacent drainages in Arizona and Sonora, México, but is listed as endangered only in the United States' portion of its range (Hendrickson *et al*. 1980, Juarez-Romero *et al*. 1988, Campoy-Favela *et al*. 1989). Its historical range in the United States encompassed the lower to mid-elevation reaches of the Río Yaqui basin, including Whitewater and Black draws. Much of the habitat in those areas has been lost to water diversion, downcutting of streams, draining of backwaters, vegetation clearing, channelization, grazing, groundwater pumping, and other human uses of the natural resources (U.S. Fish and Wildlife Service 1984). In addition, non-native fish have been introduced in many portions of its historical range in the United States. The mosquitofish (*Gambusia affinis*) is particularly damaging and was first found in the United States portion of the Río Yaqui basin in 1979 (Hendrickson *et al*. 1980, Meffe *et al*. 1983, Galat and Robertson 1992). Mosquitofish are currently extirpated from San Bernardino NWR. In the United States, Yaqui topminnow are presently found only on the San Bernardino and Leslie Canyon NWRs. The status of the species is tenuous but stable within NWR boundaries. Additional information can be found in the Rio Yaqui Fishes Recovery Plan (U.S. Fish and Wildlife Service 1995).

Critical Habitat

There is no critical habitat designated for the Yaqui topminnow.

Yaqui chub

Our June 10, 2005, Programmatic Biological and Conference Opinion for the Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwestern Region (2-22-03-F-366) included a detailed Status of the Species for the Yaqui chub. This biological opinion is available on our website at http://www.fws.gov/arizonaes, under Document Library; Section 7 Biological Opinions.

The Yaqui chub was once found throughout the Río Yaqui drainage which drains eastern Sonora and portions of western Chihuahua in Mexico, and the San Bernardino Valley in the extreme southeastern corner of Arizona (DeMarais and Minckley 1993). Currently, the Yaqui chub only occurs in the extreme northern headwaters of the Yaqui River drainage system in Mexico and various sites in the San Bernardino Valley. Populations in the U.S. reside primarily on the San Bernardino/Leslie Canyon NWR (Haynes and Schuetze 1997). While Yaqui chub have been proven to be highly resilient (DeMarais and Minckley 1991, 1993), both NWR populations are threatened by a gradually dwindling spring flow, and many river systems in Mexico, especially in lowland areas, have been highly modified into canal systems for irrigating agriculture. These alterations destroy pool habitats and have adverse impacts on Yaqui chub populations. Additionally, cattle grazing, local farming, exotic species, mining, and other activities have resulted, and may continue to result, in some detrimental habitat or landscape changes (Wagoner 1960, Minckley 1973, Schoenherr 1973, Hahman 1979, Gehlbach 1981, Humphrey 1986, U.S. Fish and Wildlife Service 1995).

Critical Habitat
Critical habitat for the Yaqui chub includes all aquatic habitats of San Bernardino NWR excluding the Leslie Canyon complex.

Yaqui catfish

Our June 10, 2005, Programmatic Biological and Conference Opinion for the Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwestern Region (2-22-03-F-366) included a detailed Status of the Species for the Yaqui catfish. This biological opinion is available on our website at http://www.fws.gov/arizonaes, under Document Library; Section 7 Biological Opinions. Herein we incorporate that status discussion by reference.

The historical range of the Yaqui catfish most likely included the uppermost Río Yaqui system in Arizona, and the basins of the Río Yaqui, Río Sonora (Miller 1940), and Río Casas Grandes in Mexico (U.S. Fish and Wildlife Service 1995), south through the Río Fuerte system (Miller 1976, 1978). The headwaters of the Río Yaqui are located in the San Bernardino Valley of southeastern Arizona. Historically, the Yaqui catfish in Arizona is believed to have occurred only in San Bernardino Creek (Black Draw). Yaqui catfish are presumed to have occurred as far north as San Bernardino Ranch; however, like many of Arizona's native fish, numerous populations were extirpated before complete distributions were determined (Haynes and Schuetze 1997). Due to reestablishment efforts in Arizona, Yaqui catfish are currently present on the San Bernardino NWR and El Coronado Ranch, primarily in manmade ponds (U.S. Forest Service 2004). Water development and pumping of underground aquifers constitute the greatest threat to the survival of Yaqui catfish, followed closely by introduction of non-native organisms. Additionally, cattle grazing, local farming, exotic species, mining, and other activities have resulted and may continue to result in some detrimental habitat or landscape changes (Wagoner 1960, Minckley 1973, Schoenherr 1973, Hahman 1979, Gehlbach 1981, Humphrey 1986, U.S. Fish and Wildlife Service 1995).

Critical Habitat
Critical habitat for the Yaqui catfish includes all aquatic habitats of San Bernardino NWR excluding the Leslie Canyon complex.

Beautiful shiner

The beautiful shiner is a small Cyprinid fish (Minckley 1973) that was listed as a threatened species on August 31, 1984. It occurred in the Río Yaqui in Arizona and in Sonora and Chihuahua, México and in the Mimbres River and Guzman basin in New Mexico and Chihuahua, México, respectively, but has been extirpated from the Mimbres River (Hendrickson *et al.* 1980, Campoy-Favela *et al.* 1989, Sublette *et al.* 1990). Water diversion, stream downcutting, backwater draining, vegetation clearing, channelization, grazing, groundwater pumping, and other human uses of the natural resources resulted in the extirpation of the beautiful shiner from the United States. In 1990, the beautiful shiner was reestablished into the San Bernardino NWR originating from collections made in 1989 from Río Moctezuma, Chihuahua, México. Additional information can be found in the Rio Yaqui Fishes Recovery Plan

(U.S. Fish and Wildlife Service 1995) and the listing package (U.S. Fish and Wildlife Service 1984).

Critical Habitat
Critical habitat for the beautiful shiner includes all aquatic habitats of San Bernardino NWR, excluding the Leslie Canyon complex.

Chiricahua leopard frog

Our June 10, 2005, Programmatic Biological and Conference Opinion for the Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwestern Region (2-22-03-F-366) included a detailed Status of the Species for the Chiricahua leopard frog. This biological opinion is available on our website at http://www.fws.gov/arizonaes, under Document Library; Section 7 Biological Opinions. Herein we incorporate that status discussion by reference. The text below includes some new information that updates that Status of the Species.

The Chiricahua leopard frog is listed as threatened and is an inhabitant of cienegas, pools, livestock tanks, lakes, reservoirs, streams, and rivers at elevations of 3,281 to 8,890 feet in central and southeastern Arizona; west-central and southwestern New Mexico; and in Mexico, northeastern Sonora, and the Sierra Madre Occidental of northern and central Chihuahua (Platz and Mecham 1984, Degenhardt *et al.* 1996, Sredl *et al.* 1997, Sredl and Jennings 2005). The species has been extirpated from about 75 percent of its historical localities in Arizona and New Mexico; the current status of the leopard frog in Mexico is unknown. Threats to this species include predation by non-native organisms, especially bullfrogs (*Rana catesbeiana*), fishes (*Micropterus* spp. and *Lepomis* spp., for example), and crayfish (*Orconectes virilis* and possibly others); disease; drought; floods; degradation and loss of habitat as a result of water diversions and groundwater pumping, poor livestock management, altered fire regimes due to fire suppression and livestock grazing, mining, development, and other human activities; disruption of metapopulation dynamics; increased chance of extirpation or extinction resulting from small numbers of populations and individuals; and environmental contamination. Additional information about the Chiricahua leopard frog can be found in Platz and Mecham (1979, 1984), Rosen *et al.* (1994), Sredl and Howland (1994), Jennings (1995), Degenhardt *et al.* (1996), Rosen *et al.* (1996), Sredl *et al.* (1997), Painter (2000), and Sredl and Jennings (2005).

Recent recovery and planning efforts for the Chiricahua leopard frog include completion of a Safe Harbor Agreement (SHA) with the Malpai Borderlands Group on March 5, 2004. Efforts continue to complete an Altar Valley SHA and a statewide SHA by 2006, if not sooner. Chiricahua leopard frogs were translocated to Sierra Blanca Lake in the White Mountains, and a refugium population was established on a ranch in the Baboquivari Mountains in 2004. A draft recovery plan is in development and should be available for public review in winter of 2005.

Additionally, other recent (2004 to present) Section 7 Biological Opinions addressing the Chiricahua leopard frog are: the reinitiation of the Historic Mail Trail Project (02-21-21-98-0399-R4) in Yavapai County; Awtry and Marks Ditch Diversion Repair on the Blue River (02-21-03-F-0046 R2) in Greenlee County; Buzzard Roost and Soldier Camp Allotments (02-21-04-

F-0273) in Gila County; Programmatic Biological and Conference Opinion for the Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwestern Region (2-22-03-F-366) for Arizona and New Mexico; Biological Opinion on the Buenos Aires National Wildlife Refuge Fire Management Plan for the 2005-2008 Burn Seasons (02-21-05-F-0243) in Pima County; Biological Opinion on the Proposed Issuance of a Term Permit to Graze Livestock for 10 Years on the Little Green Valley Complex (02-21-99-F-0300-R1) in Gila County; Biological and Conference Opinion for the BLM Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management (02-21-03-F-0210) for Arizona; Apache Trout Enhancement Project – Second Reinitiation (02-21-01-F-0101 R2) in Apache and Greenlee Counties; Verde Analysis Area Wildland Urban Interface Fuels Treatment (02-21-03-F-0213) in Gila County; Ryan Fire Biological Opinion (02-21-02-F-0157) in Santa Cruz County; and Livestock Grazing on the Kunde and Papago allotments (02-21-98-F-0399-R2). Many of these Biological Opinions anticipated some level of incidental take of leopard frogs, although none anticipated local extirpations at any site.

Critical Habitat

There is no critical habitat designated for the Chiricahua leopard frog.

Huachuca water umbel

Our December 14, 2004, Intra-Service Biological Opinion Regarding Huachuca Water Umbel on the Leslie Creek NWR (2-22-03-F-366) included a detailed Status of the Species for the Huachuca water umbel. This biological opinion is available on our website at http://www.fws.gov/arizonaes, under Document Library; Section 7 Biological Opinions. Herein we incorporate that status discussion by reference.

The Huachuca water umbel has been documented from 27 sites in Santa Cruz, Cochise, and Pima counties, Arizona, and in adjacent Sonora, Mexico, west of the continental divide (Haas and Frye 1997, Saucedo Monarque 1990, Warren *et al.* 1989, Warren *et al.* 1991, Warren and Reichenbacher 1991, Service files). The plant has been extirpated from 6 of the 27 sites. The 21 extant sites occur in four major watersheds - San Pedro River, Santa Cruz River, Río Yaqui, and Río Sonora. All sites are 3,500 to 6,500 ft. in elevation. Overgrazing, mining, hay harvesting, timber harvest, fire suppression, and other activities in the nineteenth century led to widespread erosion and channel entrenchment in southeastern Arizona streams and cienegas when above-average precipitation and flooding occurred in the late 1800's and early 1900's (Bryan 1925, Martin 1975, Hastings and Turner 1980, Dobyns 1981, Hendrickson and Minckley 1984, Sheridan 1986, Bahre 1991, Webb and Betancourt 1992, Hereford 1993). Wetland degradation and loss continues today. Human activities such as groundwater overdrafts, surface water diversions, impoundments, channelization, improper livestock grazing, chaining, agriculture, mining, sand and gravel operations, road building, non-native species introductions, urbanization, wood cutting, and recreation all contribute to riparian and cienega habitat loss and degradation in southern Arizona. The local and regional effects of these activities are expected to increase with the increasing human population.

Critical Habitat

Critical habitat has been designated for the Huachuca water umbel, but the action area does not include critical habitat.

ENVIRONMENTAL BASELINE

The environmental baseline includes past and present impacts of all Federal, State, or private actions in the action area, the anticipated impacts of all proposed Federal actions in the action area that have undergone formal or early section 7 consultation, and the impact of State and private actions which are contemporaneous with the consultation process. The environmental baseline defines the current status of the species and its habitat in the action area to provide a platform to assess the effects of the action now under consultation.

The goal of the FMP is to return fire as an integral, natural process in the maintenance of the Refuges' ecosystems, and, ultimately, to provide an overall benefit to each of the Federally listed threatened and endangered species undergoing population recovery. As a part of this process, the Refuges want to use fire in the most cost efficient, safest, and least intrusive way possible. For this reason, and for administrative and operational efficiency, some private lands immediately adjacent to the Refuges may be included in prescribed burns so that natural and human-made firebreaks can be used when possible. Refuge personnel have excellent working relationships with adjacent private landowners, and since 2003, the Refuge Manager has contacted many of the adjacent private landowners to discuss fire management interest and opportunities. For these reasons, we describe the action area to include the entirety of the San Bernardino and Leslie Canyon NWRs, as well as the private lands immediately adjacent to the Refuges up to the nearest vegetation barrier. For example, using Geronimo Trail Road as a firebreak is likely more cost efficient, safer, and less intrusive on the landscape than using the refuge fenceline located 200 yards south of Geronimo Trail Road.

San Bernardino NWR once was historical habitat for eight native fishes. These included the Yaqui chub, Yaqui topminnow, beautiful shiner, Yaqui catfish (herein referred to as the Río Yaqui fishes or Yaqui fishes), Yaqui sucker, longfin dace, Mexican stoneroller, and roundtail chub. The Yaqui sucker and roundtail chub are currently extirpated from the Refuges, but still exist in tributaries of the Río San Bernardino in Mexico.

Protection of Río Yaqui fish habitat started in 1979 with the purchase of the San Bernardino Ranch by The Nature Conservancy (TNC). The property was transferred to USFWS ownership in 1982 in order to establish the San Bernardino NWR (U.S. Fish and Wildlife Service 1987). The historic "Texas John" Slaughter home, outbuildings, and one major spring/pond complex were deeded to the Johnson Historical Foundation, with biological management remaining under U.S. Fish and Wildlife Service responsibility. Leslie Creek was added to the NWR in 1989, again through a TNC purchase transferred to the U.S. Fish and Wildlife Service.

Habitat improvements commenced immediately upon acquisition of San Bernardino NWR in 1979 and Leslie Canyon NWR in 1988. Biological processes damaged by poor grazing practices, intense farming, and occasional droughts were restored. Desirable woody plants were

reestablished along stream courses which, along with installation of gabion structures, reduced erosion and stabilized banks. Undesirable woody species were thinned, weeds in abandoned fields were mowed to benefit indigenous grasses, and some reseeding was implemented. Efforts to remove non-native fishes and to combat spread of western mosquitofish, which appeared in 1979, commenced with the renovation of House Pond. Exclusion of undesirable species through barriers, removal of native species by drying, and diversion, or capping of artesian flows followed by reestablishment of habitat and native biota were also accomplished. Mosquitofish are currently extirpated from San Bernardino NWR. Finally, cienegas were restored by piping water, allowing flow into suitable areas such as abandoned farm fields, and constructed ponds with associated stream runs where indigenous Yaqui fishes could expand populations after natural dispersal or stocking.

Other than mostly ephemeral stream channels, the San Bernardino Cienega is the most extensive wetland in the region, beginning on what is now the San Bernardino NWR in the United States and extending into Sonora for >2.5 km (1.6 mi) along Río San Bernardino (Black Draw). The cienega was well-watered in the past and existed because of its unique regional climate and hydrographic features. Land-use practices such as livestock overgrazing, water diversion, and aquifer pumping drained the wetland and incised the Río San Bernardino floodplain. Currently, however, even in its degraded state, the San Bernardino NWR provides a mosaic of wet and dry habitats that allows for a diverse assemblage of vertebrates to live in a relatively small area. The rare species that are present are listed as endangered or threatened both by Mexico and the United States. Wetland restoration (to restore the riparian and grassland habitats) in the San Bernardino Valley is a major objective on both sides of the international border.

A. STATUS OF THE SPECIES WITHIN THE ACTION AREA

Yaqui topminnow

In the United States, Yaqui topminnow are presently found only on the San Bernardino NWR and Leslie Canyon NWR. The status of the species is tenuous but stable within NWR boundaries. San Bernardino and Leslie Canyon NWR personnel surveyed eight native fish ponds and streams on the Refuges and Slaughter Ranch from March 2 through April 12, 2004 (U.S. Fish and Wildlife Service 2004a). Trapping resulted in a total of 795 Yaqui topminnow distributed within the North Fork Enclosure (637 fish), East Middle (154 fish), Tule pond (3 fish), and Hay Hollow (1 fish). Diseased native fishes (including Yaqui topminnow, Yaqui chub, and/or longfin dace) were found in over half of the native fish populations surveyed, including the North Fork Enclosure. The House Pond population at the Slaughter Ranch had the highest percentage of native fish (18 percent) infected with trematodes that cause black grub (the appearances of black spots in the skin of fishes), and Leslie Creek had the highest percentage of fish (27 percent) infected with yellow grub caused by the *Clinostomum marginatum* trematode.

Within the action area, Yaqui topminnow currently inhabit several ponds and flowing waters on the San Bernardino NWR, including Astin Spring, North Fork, Middle Pond, Oasis Pond, the Minckley Ponds, Twin Pond, Twin-II Pond, Tule Pond, Bathhouse Pond, Double-PhD Pond, and periodically in flowing portions of Black Draw. They also occur at Slaughter Ranch in House

Pond, and at the Leslie Creek NWR in Leslie Creek. There is no critical habitat designated for the Yaqui topminnow.

Yaqui chub

Yaqui chub from Dexter National Fish Hatchery and Technology Center were stocked on San Bernardino NWR in 1980, immediately following TNC's purchase. House Pond was renovated in 1984-1985 to remove mosquitofish, a species incompatible with topminnow. House pond was then restocked with Yaqui chub in 1986. Yaqui chub reappeared in Black Draw in 1987, either from the 1980 stocking or through upstream dispersal from Mexico.

Within the action area, Yaqui chub populations are managed on the San Bernardino NWR in North Fork, Oasis Pond, the Minckley Ponds, Twin Pond, Twin-II Pond, Bathhouse Pond, Double-PhD Pond, and periodically in flowing portions of Black Draw. They also occur at Slaughter Ranch in House Pond, and at the Leslie Creek NWR in Leslie Creek. Critical habitat for the Yaqui chub includes all aquatic habitats of San Bernardino NWR excluding the Leslie Canyon complex. The key constituent elements for all Río Yaqui fishes include clean, small, permanent streams and pools without any exotic fishes. The streams should have deep pool areas separated by riffles and flowing areas with moderate current. Backwater areas of streams and springs should have overgrown cut banks, and accumulations of detritus are necessary for feeding and shelter.

Yaqui catfish

In May of 1990, 400 Yaqui catfish were reestablished on San Bernardino NWR. These individuals established and expanded into today's sub-populations. They are currently found in Twin Pond and at Slaughter Ranch in House Pond. Critical habitat for the Yaqui catfish includes all aquatic habitats of San Bernardino NWR. See the Yaqui chub account, above, for a description of critical habitat.

Beautiful shiner

In 1990, beautiful shiner was reestablished into the San Bernardino NWR originating from collections made in 1989 from Río Moctezuma, Chihuahua. Within the action area, beautiful shiner occur at San Bernardino NWR in Twin Pond, Twin-II Pond, Oasis Pond, and periodically in flowing portions of Black Draw. Critical habitat for the beautiful shiner includes all aquatic habitats of San Bernardino NWR, excluding the Leslie Canyon complex. See the Yaqui chub account, above, for a description of critical habitat.

Chiricahua leopard frog

Currently, leopard frogs can be observed on San Bernardino NWR at North Fork, and they occur on Leslie Creek NWR throughout Leslie Creek. There is no critical habitat designated for the Chiricahua leopard frog.

Huachuca water umbel

Huachuca water umbel occurs along the banks of Leslie Creek, within Leslie Creek NWR. The amount of area occupied by Huachuca water umbel in Leslie Creek is estimated to be 291.81 ft^2 (27.11 m^2). Patch size and density of Huachuca water umbel varies along Leslie Creek; but, overall, the population seems stable. The Refuge has raised concerns regarding the long-term persistence of Huachuca water umbel at this site, as the U.S. Geological Service maintains a flow monitoring station along Leslie Creek and must periodically remove soil and vegetation from around the gauge. Additionally, water levels have been declining in Leslie Canyon, and in 2003 a trespass bull trampled Huachuca water umbel and habitat in the Leslie Creek area. For these reasons, the Refuge has coordinated with USGS and salvaged Huachuca water umbel patches for a transplant study at San Bernardino NWR in areas that previously supported the species. Huachuca water umbel was known to occur at San Bernardino NWR, but apparently was extirpated by dredging activity in the 1990s. Patches of the plant were recently transplanted in Black Draw, at the outlet of Twin-II Pond, and at the upstream end of Twin-II Pond in an effort to ensure the persistence of Huachuca water umbel on the Refuge. The patches in Twin-II Pond were outcompeted and essentially eliminated by other native wetland species, but the Black Draw patches are still viable (W. Radke, pers. comm.). Critical habitat has been designated for the Huachuca water umbel, but the action area does not include critical habitat.

B. FACTORS AFFECTING SPECIES ENVIRONMENT WITHIN THE ACTION AREA

Factors affecting the species' environment are similar for the Yaqui chub, Yaqui topminnow, beautiful shiner, and Yaqui catfish; therefore, they will be collectively grouped as the Río Yaqui fishes herein.

Río Yaqui fishes

The populations of Río Yaqui fishes are very small and isolated, making them vulnerable to stochastic environmental events such as drought and floods. A significant potential threat to the populations is illegal introduction of non-native predators and competitors to these ponds. The effects of increased illegal immigration and Border Patrol activities likely have little impact on the Río Yaqui fish populations, because the ponds in which they occur are relatively large and the potential for impacts from immigrants drinking or walking in the water are insignificant. The use of these ponds for bathing and personal hygiene may result in some decrease in water quality, but effects of this type have not been studied or documented.

Activities on surrounding lands that lower the ground water level and cause decreased water flow from springs on San Bernardino NWR would adversely impact the species and critical habitat. Such activities include, but are not limited to, pumping of ground water for agricultural purposes and drilling activities associated with geothermal exploration. Any activity that would significantly alter the water chemistry of springs on San Bernardino NWR could adversely impact the critical habitat. Such activities include, but are not limited to, release of chemical or biological pollutants into surface or underground waters at a point source or by dispersal release.

South of San Bernardino NWR, recent (2003) development of extensive pistachio (*Pistacia* spp.) orchards has occurred in Sonora. Water use in these agricultural developments may threaten wetlands and fish habitat on this Refuge (U.S. Fish and Wildlife Service 2004b).

Prior section 7 consultations with Federal agencies have influenced the environmental baseline within and in close proximity to the action area. There have been eleven formal consultations involving Yaqui chub and Yaqui topminnow since 1991 (Table 1). These consultations included spring restoration, livestock grazing, fire management planning, habitat renovation and reestablishment of these fishes, and changes to the Arizona Water Quality Standards. The consultations involving livestock grazing and fire management each included measures to reduce adverse effects and minimize take of Yaqui topminnow and resulted in non-jeopardy determinations. Several actions have also resulted in meaningful improvements in the environmental baseline of the respective Yaqui fishes. In particular, the Coronado National Forest's 1999 West Turkey Creek Native Fish Habitat Renovation Project (02-21-99-F-0130) and the San Bernardino and Leslie Canyon NWRs' 2003 Tule Spring Restoration (02-21-03-F-0261) improved and expanded habitat for these species and, thus, contributed to recovery.

Additionally, a Habitat Conservation Plan (HCP) is currently being developed for the private lands surrounding San Bernardino NWR. A working group consisting of representatives from Federal (including the Refuges) and state agencies and the Malpai Borderlands Group have been developing guidelines for activities in the Malpai area. One of these activities is prescribed fire. The goal of using prescribed fire in the HCP is similar to that of the Refuges: to return fire as an integral, natural process on the landscape encompassed by the Malpai borderlands. To minimize the effects of fire on aquatic species within the Malpai area, the working group has developed guidelines for prescribed fire that are based on watersheds, in which no more than 25 percent of any one watershed will be burned within a one-year period, and no more than 50 percent of any one watershed will be burned within a five-year period. Additionally, an area may not be burned more frequently than once in 5 years.

Chiricahua leopard frog

Threats to this species are from invasion of exotic predators, primarily bullfrogs, loss of aquatic habitats to drought, chytridiomycosis (an introduced fungal skin disease), and possibly environmental contamination. The effects of increased immigration and Border Patrol activities likely have little impact on Chiricahua leopard frogs, since the occupied ponds are relatively large and the potential for impacts from immigrants (undocumented aliens) drinking or walking in the water are insignificant. The use of these ponds for bathing and personal hygiene may result in some decrease in water quality, but effects of this type have not been studied or documented.

Numerous studies indicate that declines and extirpations of Chiricahua leopard frogs are at least in part caused by predation and possibly competition by non-native organisms, including fish in the family Centrarchidae, bullfrogs, tiger salamanders (*Ambystoma tigrinum mavortium*), crayfish, and several other species of fish (Clarkson and Rorabaugh 1989, Rosen *et al.* 1994, Sredl and Howland 1994, Fernandez and Bagnara 1995, Fernandez and Rosen 1996, Rosen *et al.* 1996, Snyder *et al.* 1996, Fernandez and Rosen 1998). For instance, in the Chiricahua region of

southeastern Arizona, Rosen *et al.* (1996) found that almost all perennial waters investigated that lacked introduced predatory vertebrates supported Chiricahua leopard frogs. All waters except three that supported introduced vertebrate predators lacked Chiricahua leopard frogs. Sredl and Howland (1994) noted that Chiricahua leopard frogs were nearly always absent from sites supporting bullfrogs and non-native predatory fish. Rosen *et al.* (1996) suggested further study was needed to evaluate the effects of mosquitofish, trout, and catfish on frog presence.

A bullfrog eradication program was in effect on San Bernardino NWR in all ponds from 1985 to 1989 and from 1992 to 1999 to assist in Chiricahua leopard frog recruitment. This program ended in 1999 (P. Rosen, pers. comm.). Bullfrogs still in persist in good numbers at the Refuge.

Chytridiomycosis was first noted in the San Bernardino Valley in 1996 at Belency Tank on the Magoffin Ranch, where the frog population declined abruptly and is now extirpated. At the same time, the population at Leslie Canyon declined probably as a result of chytridomycosis, but frogs at this site have persisted with the disease at a low density. Chytridiomycosis was also associated with the decline and loss of Chiricahua leopard frog populations at a "ranarium" and frog enclosure at San Bernardino NWR and was also detected in frogs at Douglas High School ponds (Bradley *et al.* 2002, Rosen 2002). Humans probably distribute the pathogen in many ways (Carey *et al.* 2003). For example, chytrids could be spread by tourists or fieldworkers sampling aquatic habitats (Halliday 1998). The fungus can exist in water or mud and thus could be spread by wet or muddy boots, vehicles, cattle, and other animals moving among aquatic sites, or during scientific sampling of fish, amphibians, or other aquatic organisms. Once introduced to a site, it is also likely spread around the landscape by bullfrogs, tiger salamanders, and other organisms that can carry the disease (Carey *et al.* 2003, Collins *et al.* 2003).

Hale and Jarchow (1988) suggested arsenic and or cadmium poisoning might be contributing factors in die-offs of leopard frogs and Tarahumara frogs in southeastern Arizona. Cadmium originating from airborne emissions from copper smelters in southeastern Arizona and northern Sonora was identified as a possible source of the contaminants. Precipitation collected in 1984-5 in southeastern Arizona had a depth-weighted mean pH of 4.63 and carried high levels of sulfate, arsenic, cadmium, copper, lead, and zinc. High acidity and sulfate concentration occurred when upper-level winds were from the directions of copper smelters, particularly those at Douglas, Arizona and Cananea, Sonora (Blanchard and Stromberg 1987). These smelters are now closed, and another at Nacozari, Sonora is equipped with pollution control scrubbers; hence any associated contaminant problems should be in decline. How long it might take for residual elevated levels of cadmium, arsenic, and other smelter-related contaminants in the environment to disperse is unknown.

Many environmental factors or stressors may interact with chytridiomycosis synergistically to either increase the virulence of the disease or compromise the immune systems of amphibians (Lips 1999). These factors or stressors may include increased levels of contaminants (such as cadmium, arsenic, pesticides and others), but also acidic rainfall, climate or microclimate (e.g. temperature, moisture) change, cold winters, increased UV-B radiation, or other changes in habitats that cause stress and immunosuppression (Carey *et al.* 1999, 2001; Parris and Baud 2004; Hale *et al.* in press).

Huachuca water umbel

Limited numbers of populations and the small size of populations make the Huachuca water umbel vulnerable to extinction as a result of stochastic events that are often exacerbated by habitat disturbance. For instance, the restriction of this taxon to a relatively small area in southeastern Arizona and adjacent Sonora increases the chance that a single environmental catastrophe, such as a severe tropical storm or drought, could eliminate populations or cause extinction. In addition, populations are almost always isolated, which makes the chance of natural recolonization after extirpation less likely. Small populations are also subject to demographic and genetic stochasticity, which increases the probability of population extirpation (Wilcox and Murphy 1985, Shafer 1990).

A suite of non-native plant species has invaded wetland habitats in southern Arizona (Stromberg and Chew 1997), including those occupied by the Huachuca water umbel (Arizona Department of Water Resources 1994). In some cases their effect on the umbel is unclear. There are no naturally occurring water umbel patches in managed wetland ponds at San Bernardino NWR (although it is persisting in Black Draw), and the patches transplanted to ponds were all quickly outcompeted and essentially eliminated by other wetland species. Bermuda grass (*Cynodon dactylon*) grows at San Bernardino NWR but does not appear to be a problem at Leslie Canyon NWR. Watercress is another non-native plant now abundant along perennial streams in Arizona. Water umbel grows together with watercress at Leslie Canyon, but watercress does not appear to stress the umbel. Water umbel seems to do best along the stream courses where flooding and scouring periodically remove competing vegetation while the umbel persists due to its rhizomes.

Within the action area, dredging extirpated the Huachuca water umbel from House Pond, near the extant population in Black Draw (Warren *et al.* 1991). Previous Federal actions that have been consulted on in the action area are: Huachuca Water Umbel Research and Management (02-21-04-F-0484), Tule Spring Restoration (02-21-03-F-0261), and Reintroduction of Yaqui catfish and Yaqui sucker on San Bernardino NWR (02-21-97-F-0143).

EFFECTS OF THE ACTION

Effects of the action refer to the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated and interdependent with that action, which will be added to the environmental baseline. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Indirect effects are those that are caused by the proposed action and are later in time, but are still reasonably certain to occur.

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 C.F.R. 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

Río Yaqui fishes

Prescribed fire

Prescribed fire can lead to elevated soil particle transport due to short-term loss of soil-shielding vegetation and natural litter. Until re-growth occurs, this sediment and the ash resulting from fuel combustion may enter wetlands. The actual amount of erosion and resultant potential silt and ash discharge into wetlands is highly variable, depending almost entirely on the intensity and duration of precipitation events. Studies have shown that large, post-fire hydrologic events can kill fish and extirpate local populations (Novak and White 1990; Propst *et al.* 1992; Bozek and Young 1994; Rinne 1975, 1996; Rieman *et al.* 1997). Recolonization rates depend on the proximity and relative location of refuges, access from refuges to disturbed areas (i.e. no fish barriers), and the occurrence of complex life history traits and overlapping generations (Gresswell 1999; Dunham *et al.* 2003). Due to the widespread fragmentation of native fish habitat in Arizona, isolated fish populations, such as those at San Bernardino and Leslie Canyon NWRs, are at a much higher risk of extinction because they cannot recolonize after a large disturbance (Rinne 1996).

Little precipitation occurs at San Bernardino and Leslie Canyon NWRs during spring and fall, and while substantial rainfall can occur on the Refuges during winter, this precipitation rarely results in runoff events. Heavy precipitation is most likely to occur on the Refuges with intense summer thunderstorms. The effects of these precipitation events may be felt in the natural wetland habitat on the Refuges (such as Black Draw and Leslie Creek), but not in the constructed ponds. The geographic and topographic position of the Refuge ponds does not typically result in overland precipitation input, thus neither a significant amount of silt nor ash could be washed into Refuge ponds occupied by fish if heavy rain followed a prescribed fire.

Within the natural wetland communities, the effects of precipitation events following a fire may be felt, and critical habitat for the Yaqui chub, Yaqui catfish, and beautiful shiner may be negatively impacted. Erosion of soils from upland areas can contribute to bank erosion in stream channels and siltation of riparian and aquatic plants. Soil erosion also leads to increased sediment-loading in streams. Post-fire erosional processes that deliver sediment to streams over long periods of time due to roads, fire lines, or the lack of re-vegetation, can have long-term negative effects on aquatic ecosystems (Lotspeich *et al.* 1970; DeByle and Packer 1972).

In situations where native fishes escape mortality and local extirpation from hydrologic events, they may still experience changes to the riparian and fluvial system that can render their habitat temporarily uninhabitable. Loss of riparian vegetation reduces shading, which increases water temperatures. High stream temperatures correlate with reduced dissolved oxygen, and high levels of nitrates and nitrogen can cause eutrophication (Ffolliott *et al.* 2004). Southwestern native fishes, and the endemic poecilliids and cyprinids in particular, have been documented to persist in highly adverse conditions (Deacon and Minckley 1974, Meffe *et al.* 1983, Meffe and Snelson 1989, Minckley *et al.* 1977). However, regardless of this adaptation, the tenuous status of the Río Yaqui fishes makes such challenges undesirable.

Smoke contributes nitrogen and ammonia to aquatic ecosystems. Ammonia is toxic to fish. The absorption of smoke and nitrogen into the water depends on how long the smoke lingers near the water. Fires also generate ash, and incomplete combustion of materials creates charcoal. Elevated peak flow volumes and velocities are associated with increased transport of ash and nutrients (Ffolliott *et al.* 2004). Heavy ash and soot loads in water clog the gills of fish and lead to acute and chronic chemical effects, including death. The runoff of ash contributes phosphoric nutrients to aquatic ecosystems, and the presence of charcoal in water is associated with reduced dissolved oxygen concentrations. Both ammonia and phosphorus levels have been documented to be above lethal limits to fish during fires (Spencer and Hauer 1991). Changes in the pH and dissolved oxygen can render habitat unsuitable for fish. As nutrient-filled ash flows into streams, it changes the pH and nutrient level of the water (Karle 2000).

Fires can alter aquatic food webs to the detriment of native fishes. Periphyton biomass has been documented to decrease initially after a fire but then increases due to increased light availability and increased temperature (Minshall *et al.* 1990). Periphyton biomass would hypothetically decrease gradually to pre-fire levels as riparian vegetation reestablishes itself and increases stream shading (Minshall *et al.* 1989), although no studies have been conducted on the long-term effects of fire on periphyton communities.

The effects of fire on macroinvertebrates have been well studied since the early 1980s (La Point *et al.* 1983; Minshall *et al.* 1989; Roby 1989; Roby and Azuma 1995; Minshall *et al.* 1990; Richards and Minshall 1992; Jones *et al.* 1993; Lawrence and Minshall 1994; Robinson *et al.* 1994; Minshall *et al.* 1995; Mihuc *et al.* 1996; Minshall *et al.* 1997; Minshall 2003; Spencer *et al.* 2003). Macroinvertebrate communities are strongly influenced by substrate instability associated with post-fire erosional processes. Effects include changes in functional feeding groups (La Point *et al.* 1983), more annual variation (Richards and Minshall 1992), abundance, diversity, and species richness (Roby 1989; Lawrence and Minshall 1994; Minshall *et al.* 1995; Mihuc *et al.* 1996; Minshall 2003). Changes can persist for many years. Roby (1989) found that diversity was lower in burned streams compared to reference streams nine years after a fire. Species best adapted to post-fire stream conditions can be characterized as those that prefer a broad range of physical habitat (Mihuc *et al.* 1996). Taxa that require specialized habitats respond much slower to disturbances such as fire (Mihuc *et al.* 1996).

In addition to temporary effects on fish habitat, post-fire fluvial adjustments can remove native fish habitat. Post-fire, sediment- and debris-bulked peak flows can result in downcutting of channels. Once downcut, subsequent floodflows may be contained entirely within the channel and unable to inundate now-perched floodplains (Rosgen 1996). Native fishes that require access to low-velocity floodplains to avoid being transported downstream and/or to colonize upstream areas will be adversely affected. Lateral erosion of stream channels will increase width to depth ratios, resulting in decreased unit velocities in the cross section. These decreased unit velocities will result in the deposition of larger particle sizes, often cobbles, in systems formerly dominated by gravels, and boulders in systems formerly dominated by cobbles. This aggradation of sediment can fill pools and other persistent features, reducing or eliminating habitat for native fishes.

Considering all of the above, it is unlikely that an entire population (i.e., all in Leslie Creek or all in Black Draw) of Río Yaqui fishes would be eliminated due to the proposed action; however, mortality of some fish is expected. The Conservation Measures include actions to minimize the negative impacts of prescribed fire, including: working with the AFD staff to prepare and plan for burns; monitoring of all fire activity; burning fuel in small-scale prescribed burns to prevent large wildfires; using MIST during prescribed burns; and implementing post-fire emergency rehabilitation when needed. These measures minimize the effects of prescribed fire on Río Yaqui fishes and their critical habitat in the short-term, and benefit these species and their habitat in the long-term. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Emergent vegetation in wetland ponds

Prescribed burns will be planned and conducted occasionally on specific wetlands on San Bernardino NWR to control emergent vegetation such as cattails. This will have no effect on soil particle transport, but would be expected to increase ash presence in ponds occupied by Río Yaqui fishes. Additionally, smoke may be absorbed into the water and may have similar effects to those discussed above. However, fire can occur in Refuge wetlands without take of listed species. During both 2004 and 2005, wildfires occurred on San Bernardino NWR in emergent cattail-dominated vegetation (most likely due to illegal immigration activities), and in both instances, Refuge staff did not document any mortality after closely monitoring the post-fire effects on native fish and tadpoles.

Some individual fishes are expected to be killed or injured incidental to capture operations during pond draining, and some will likely not be captured and will be lost during prescribed fires. When fish move or are moved into novel habitats, there can be a period of adjustment while the system equilibrates. During this time, certain resources may be limiting and competition can be greater than normal, negatively impacting some individuals.

Critical habitat may be negatively impacted for the same reasons as detailed above.

Considering all of the above, it is unlikely that an entire population (e.g., all in Tule Pond or all in Twin Pond) of Río Yaqui fishes would be eliminated due to the proposed action, although some individuals will be incidentally taken. The Conservation Measures include actions to minimize the negative impacts of prescribed fire when controlling emergent vegetation in wetland ponds, including: timing prescribed burns in wetlands during the cool season, when dissolved oxygen levels are high; removing fish from ponds prior to burning; opportunistically eliminating non-native species during seining; burning ponds on a rotational basis so that in any given year there are always a large number of undisturbed wetlands; and monitoring of all fire activity. These measures minimize the effects of prescribed fire when controlling emergent vegetation in wetland ponds on Río Yaqui fishes and their critical habitat in the short-term. In the long-term, the fishes will benefit from the proposed action due to control of emergent vegetation in the ponds and improvements in the watershed. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Non-fire applications

Mechanical fuel treatments may include mowing areas of light vegetation, creating and maintaining fire breaks, removing or reducing heavy fuel loadings prior to reintroducing fire, and removing emergent vegetation in wetland areas. Mechanical removal of vegetation may cause disturbance to vegetation and may disturb soils that could potentially erode or run off into streams. Certain physical effects of mechanical fuel treatments can be similar to those management actions that involve fire. The effects of non-fire vegetation management actions on sediment-loading and fluvial features, however, are expected to be less severe, as the actions are: (1) pre-planned and specifically implemented to avoid and minimize effects; (2) do not consume massive amounts of non-living organic ground cover; and (3) create no hydrophobicity in soils.

Chemical treatments may include vegetation treatments around improvements, invasive/exotic vegetation treatments on the uplands, mechanical/chemical treatments of native woody species in undesirable areas, and wetland treatments to assist in the control of emergent vegetation. Chemical herbicides can be acutely toxic to fish or their prey base (Norris *et al.* 1991), and inadvertent contamination of water sources can directly and indirectly affect fish. If chemical agents are transferred to water sources, purposefully or incidentally, the watershed could experience decreased water quality, thus decreasing the feeding and breeding success of Río Yaqui fishes. Because the Department of Agriculture standards are set up to protect humans rather than fish, herbicide applications need to be scheduled and designed to minimize potential effects to non-target plants, as well as fish species.

Considering the above, it is unlikely that an entire population (e.g., all in Leslie Creek or all in Twin Pond) of Río Yaqui fishes would be eliminated due to the proposed action, although individual fish are likely to be incidentally taken. The Conservation Measures include actions to minimize the negative impacts of non-fire applications, including: using MIST, which include prohibiting the use of heavy equipment; selecting and applying herbicides in a manner that mitigates potential effects to riparian areas and their wildlife; and strictly monitoring impacts of herbicide applications on fish to minimize adverse effects. These measures minimize the effects of non-fire applications on Río Yaqui fishes and their critical habitat in the short-term. In the long term, we expect the Río Yaqui fishes to benefit from the proposed action due to management of emergent vegetation and reduction of heavy fuel loadings. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Wildfire suppression

Wildfire suppression efforts may include building or enhancing dry fire breaks, physical trampling, vehicle use, and in some cases, backfiring to reduce available fuel loads. If these events occur in or near a riparian area, the immediate loss of riparian vegetation from fire suppression reduces the ability of the riparian vegetation to provide shade-cover and food sources, stabilize stream channels, reduce siltation, maintain near stream microclimates, and other important functions that directly affect fish and their habitats.

The construction of roads and fire lines during suppression actions can also affect aquatic ecosystems. Roads, trails, and fire lines can act as relatively impermeable surfaces and, when connected into a network, can result in changed peak flow dynamics as well as increased sediment-loading in adjacent streams. These processes may be aggravated by the fact that temporary roads and fire lines are seldom engineered to include proper drainage, culverts or armored fords, or drainage buffers (Furniss *et al.* 2000). Activities associated with vehicles and equipment within or near occupied habitat would likely result in habitat destruction and mortality of listed native fishes.

Backfires set during fire suppression activities can lead to elevated soil particle transport due to short-term loss of soil-shielding vegetation and natural litter. These effects are similar to the effects of prescribed fire described above.

Considering the above, it is unlikely that an entire population (e.g., all in Leslie Creek or all in Twin Pond) of Río Yaqui fishes would be eliminated due to the proposed action, although some mortality is likely. The Conservation Measures include actions to minimize the negative impacts of wildfire suppression, including: coordinating with external fire response units to prepare and plan for fire activities; monitoring of all fire activity; burning fuel in small-scale prescribed burns to prevent large wildfires; using MIST; and implementing post-fire emergency rehabilitation when needed. These measures minimize the effects of wildfire suppression on Río Yaqui fishes and their critical habitat in the short-term, and the proposed action as a whole benefit these species and their habitat in the long-term. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Chiricahua leopard frog

Prescribed fire

Fire and subsequent degradation of watershed condition immediately after fires can result in dramatically increased runoff, sedimentation, debris flow that can scour aquatic habitats in canyon bottoms or bury them, and ash flow that can create toxic conditions (described above). Amphibian communities, including frog populations, can be significantly altered following prescribed fires, and recovery of these areas may take 12 or more years post-fire for southern leopard frog (*Rana sphenocephala*) populations (Schurbon and Fauth 2003). In Romero Canyon, Catalina Mountains, Pima County, Arizona, lowland leopard frogs (*Rana yavapaiensis*) and their habitat were severely reduced due to runoff and sedimentation following the Aspen Fire in 2003. Loss of occupied habitat also occurred in Buehman Canyon and probably other localities in the Catalina Mountains due to recent catastrophic fires (Wallace 2003). At Saguaro National Park East, similar loss of lowland leopard frog habitat has also occurred due to post-fire sedimentation and ash flow (Don Swann, pers. comm. 2002). Additionally, smoke diffusion into water and ash flow can result in high levels of phosphorus and nitrogen (Spencer and Hauer 1991) with potentially toxic effects to frogs.

Probably of greater consequence would be the effect of ash flows on eggs and tadpoles. Adults most likely could escape an ash flow but aquatic life stages would likely perish. Anecdotal post-fire observations of Tarahumara frog and lowland leopard frog populations in Arizona in 2005

support this hypothesis. Following the 1994 Rattlesnake fire in the Chiricahua Mountains of Arizona, a debris flow filled Rucker Lake, a historical Chiricahua leopard frog locality. The impacts of ash/sediment flow from the large Fire Use fires on the Gila NF from 2001 to 2003 appear to be a real threat to the Chiricahua leopard frog, causing extirpation in both the Middle Fork and West Fork of the Gila River (Jennings, pers. comm. 2004).

The effects of prescribed fire on leopard frogs are similar to those described above for Río Yaqui fishes. In addition, the short-term negative effects are outweighed by the long-term benefits for the same reasons as described above for Río Yaqui fishes. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Emergent vegetation in wetland ponds

The effects of controlling emergent vegetation in wetland ponds on Chiricahua leopard frogs, tadpoles, and eggs are similar to those described above for Río Yaqui fishes. Chiricahua leopard frogs are not known to inhabit ponds where control of emergent vegetation is proposed, but they could colonize these sites in the future. The short-term negative effects of controlling emergent vegetation in wetland ponds are greatly outweighed by the long-term benefits for the same reasons as described above for Río Yaqui fishes. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Non-fire applications

The effects of non-fire applications on Chiricahua leopard frogs, tadpoles, and eggs are similar to those described above for Río Yaqui fishes. Additionally, the use of chemicals may result in death and deformity of multiple life stages of frogs, and, at a minimum, any herbicide or insecticide in the waters could likely result in reduced breeding success through lack of cover and reduced feeding success through lack of prey and forage items.

Amphibians in general, and ranid frogs in particular, are quite sensitive to pesticides and other chemical insult. These chemicals have a variety of direct and indirect effects on amphibians (Sparling 2003). Airborne movement and deposition of acidic compounds, pesticides, and potentially other chemicals over long distances can affect otherwise pristine areas that do not receive direct applications (Blanchard and Stromberg 1987, Davidson *et al*. 2002), and some pesticides may cause sublethal effects at very low dosages (Hayes *et al*. 2002, Hayes 2004; but see Carr *et al*. 2003).

Considering the above, it is unlikely that an entire population (e.g., all in Leslie Creek) of Chiricahua leopard frogs, tadpoles, and eggs would be eliminated due to the proposed action, although some mortality is likely. The Conservation Measures include actions to minimize the negative impacts of non-fire applications, including: using MIST, which include prohibiting the use of heavy equipment; selecting and applying herbicides in a manner that mitigates potential effects to riparian areas and their wildlife; and annual monitoring. These measures minimize the effects of non-fire applications on Chiricahua leopard frog populations in the short-term, and the proposed action in general benefits the species and its habitat in the long-term. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Wildfire suppression

The effects of wildfire suppression on Chiricahua leopard frogs, tadpoles, and eggs are similar to those described above for Río Yaqui fishes. The short-term negative effects are outweighed by the long-term benefits for the same reasons as described above for Río Yaqui fishes. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Huachuca water umbel

Prescribed fire

The Huachuca water umbel experiences damage, loss of above-ground stems, scouring, and sedimentation during flash flood events, and could potentially be lost if a large flash flood event occurs as the result of a prescribed fire. In some cases, however, the damage may be short-term, because the species grows and spreads through rhizomes and can rapidly expand its population and occupy disturbed habitat until interspecific competition exceeds its tolerance. For an opportunistic plant species such as the Huachuca water umbel, the short-term effect of fire may appear to be detrimental to individual plants while the long-term environmental changes that result from burning may be beneficial because competition for light and nutrients from "overstory" species, such as grasses, sedges, or annual plants, is removed. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Emergent vegetation in wetland ponds

There is no Huachuca water umbel within wetland ponds on the San Bernardino NWR. Therefore proposed activities within these ponds will not affect the umbel.

Non-fire applications

Mechanical fuel treatments may include mowing areas of light vegetation, creating and maintaining fire breaks, removing or reducing heavy fuel loadings prior to reintroducing fire, and removing emergent vegetation in wetland areas. Mechanical removal of vegetation may cause disturbance to vegetation and may disturb soils that could potentially erode or run off into streams. Certain physical effects of mechanical fuel treatments can be similar to those management actions that involve fire. The effects of non-fire vegetation management actions on sediment-loading and fluvial features, however, are expected to be less severe, as the actions are: (1) pre-planned and specifically implemented to avoid and minimize effects; (2) do not consume massive amounts of non-living organic ground cover; and (3) create no hydrophobicity in soils. Little is known about the effects of chemical herbicides on Huachuca water umbel. Further study is necessary to determine the effects on the umbel. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Wildfire suppression

Wildfire suppression efforts may include building or enhancing dry fire breaks, physical trampling, vehicle use, and in some cases, backfiring to reduce available fuel loads. If these events occur in or near a riparian area, the immediate loss of riparian vegetation from fire suppression reduces the ability of the riparian vegetation to stabilize stream channels, reduce siltation, maintain near stream microclimates, and other important functions that may affect the Huachuca water umbel.

The construction of roads and fire lines during suppression actions can also affect aquatic ecosystems. Roads, trails, and fire lines can act as relatively impermeable surfaces and, when connected into a network, can result in changed peak flow dynamics as well as increased sediment-loading in adjacent streams. These processes may be aggravated by the fact that temporary roads and fire lines are seldom engineered to include proper drainage, culverts or armored fords, or drainage buffers (Furniss *et al.* 2000). Activities associated with vehicles and equipment within or near occupied habitat would likely result in habitat destruction and mortality of the Huachuca water umbel.

Backfires set during fire suppression activities can lead to elevated soil particle transport due to short-term loss of soil-shielding vegetation and natural litter. These effects are similar to the effects described above. See the Summary below for a detailed analysis of the proposed Conservation Measures.

Summary

In summary, the long-term benefits of the proposed action greatly outweigh the short-term negative effects on the species considered, and the proposed action works toward the recovery of the listed species. The Conservation Measures minimize the effects of the action as detailed below:

Prescribed fire

- The Refuges have established guidelines to minimize the effects of prescribed fire on their natural wetland habitats. The FMP outlines goals and objectives for each FMU within the Refuges, which will provide for long-term benefits and work towards recovery of the listed species. The goals of the FMP greatly minimize the risk of adverse effects to Río Yaqui fishes and their critical habitat, Chiricahua leopard frogs, and Huachuca water umbel due to prescribed fire.

- MIST will be used whenever possible during fire management activities to reduce impacts to natural resources.

- Pre- and post-burn monitoring will occur to provide refinement to prescribed burn applications and to reduce potential adverse effects to Río Yaqui fishes, their critical habitat, Chiricahua leopard frogs, and Huachuca water umbel.

- Should an incident occur that calls for post-fire emergency rehabilitation (stabilization) and restoration, the Refuges will follow protocols as outlined in the Interagency Burned Area Emergency Stabilization and Rehabilitation Handbook. One objective of these protocols is to prevent unacceptable degradation to natural resources resulting from the effects of fire. Therefore, the short-term adverse effects of implementing post-fire rehabilitation will be outweighed by long-term benefits.

Emergent vegetation in wetland ponds

- To enhance critical habitat for Río Yaqui fishes and habitat for Chiricahua leopard frogs on San Bernardino NWR, the Refuge proposes to burn emergent vegetation within constructed wetland ponds to maintain open water. Prior to ignition, fish and tadpoles will be salvaged from the pond and relocated to another pond until habitat within the original pond has returned to pre-burn conditions. Where "mirror image" ponds have been constructed, both ponds will never be drained and burned during the same year, so one of the pair will always be available to temporarily hold the fish and tadpoles while the other is being managed with fire. Additionally, non-native species will be opportunistically eliminated during seining. Over the long term, this action benefits Río Yaqui fishes and Chiricahua leopard frogs by creating and maintaining habitat.

- The loss of individuals due to salvage efforts should be a minor part of the Refuge's fish and frog populations, so the loss of these individuals is unlikely to negatively affect the species' populations overall.

- Pre- and post-burn monitoring will occur to provide refinement to emergent vegetation control in constructed wetland ponds and to reduce potential adverse effects to Río Yaqui fishes and Chiricahua leopard frogs.

<u>Non-fire applications</u>

- Mechanical fuel treatments may be employed to mow areas of light vegetation, create and maintain fire breaks, remove or reduce heavy fuel loadings prior to reintroducing fire, remove emergents in wetland areas, and/or protect cultural/historic sites. The adverse effects of these treatments are short-term and are expected to benefit Río Yaqui fishes, Chiricahua leopard frogs, and Huachuca water umbel in the long-term.

- Herbicide selection and application methods will be designed to mitigate any potential effects to riparian areas and their wildlife. Strict monitoring of impacts on fish populations will be done in order to minimize the adverse effects of herbicides. This monitoring will assist in managing fish populations not only on the Refuges, but will provide valuable research that can be used outside of the Refuges, as well.

<u>Wildfire suppression</u>

- MIST will be used whenever possible during fire management activities to reduce impacts to natural resources.

- During wildfire control, the following will not be used on either Refuge: fire retardant, foam agent, explosives, bulldozed fire line, and removal of water from any pond, tank, or stream. Off-road travel on the Refuges without the presence of a Resource Advisor is prohibited. These actions greatly reduce the potential adverse effects on Río Yaqui fishes, their critical habitat, Chiricahua leopard frogs, and Huachuca water umbel.

- Post-fire emergency rehabilitation (stabilization) and restoration may be needed in some cases. As described for "Prescribed Fire", above, the short-term adverse effects of implementing post-fire rehabilitation will be outweighed by long-term benefits.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

To the south, San Bernardino NWR adjoins ranchlands in Sonora that support a variety of activities that have some adverse effects on species addressed herein (see Environmental Baseline). These activities are expected to continue in the future. In Arizona, San Bernardino NWR is completely surrounded by private and State Trust Lands that are within the Malpai Borderlands area. The Malpai Borderlands Group is currently developing a HCP for this area, which will be subject to additional Section 7 consultation. Leslie Canyon NWR is not within the border of the Malpai Borderlands area, and is surrounded by a mosaic of private land, State Trust Land, and BLM land. Activities on BLM land are subject to additional Section 7 consultation. Activities may occur on private and State Trust Land within the vicinity of both Refuges and may include water development and pumping of underground aquifers, which may affect the species discussed in this opinion. If State Trust Land is sold at auction, development may occur on some of these lands. Additionally, cross-border activities along the U.S./Mexico border continue to increase, and impacts to the action area may include increases in human traffic, deposition of trash, new trails from human traffic, soil compaction and erosion, fire risk from human traffic, water depletion and contamination, introduction and spread of disease, and interference of survey, monitoring, and research. Natural events such as floods, the effects of which may be exacerbated by human activities, are also expected, and have the potential to spread non-native species and/or significantly affect the species within the natural wetland areas (such as Leslie Creek and Black Draw).

CONCLUSION

After reviewing the current status of the Yaqui topminnow, Yaqui chub, Yaqui catfish, beautiful shiner, Chiricahua leopard frog, and Huachuca water umbel, the environmental baseline for the action area, the effects of the proposed FMP, and the cumulative effects, it is our biological opinion that implementation of the FMP at San Bernardino and Leslie Canyon NWRs, as proposed, is neither likely to jeopardize the continued existence of the Yaqui topminnow, Yaqui chub, Yaqui catfish, beautiful shiner, Chiricahua leopard frog, and Huachuca water umbel, nor

likely to destroy or adversely modify designated critical habitat for the Yaqui chub, Yaqui catfish, and beautiful shiner. No critical habitat has been designated for the Yaqui topminnow and Chiricahua leopard frog, and the action area does not include critical habitat for the Huachuca water umbel, thus none will be affected.

We present these conclusions for the following reasons:

- The Conservation Measures outlined in the FMP sufficiently minimize the adverse effects of the proposed action to the species considered.

- The long-term benefits of the FMP greatly outweigh the short-term negative effects to the species considered. The goal of the FMP is to work towards recovery of the listed species, and it will maintain and/or improve the existing habitat for these species.

The conclusions of this biological opinion are based on full implementation of the project as described in the Description of the Proposed Action section of this document, including all Conservation Measures that were incorporated into the project design.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulations pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is defined (50 CFR 17.3) to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. "Harass" is defined (50 CFR 17.3) as intentional or negligent actions that create the likelihood of injury to listed species to such an extent as to significantly disrupt normal behavior patterns which include, but are not limited to, breeding, feeding or sheltering. "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by the Refuges so that they become binding conditions of any grant or permit issued to the Refuges, as appropriate, for the exemption in section 7(o)(2) to apply. The Refuges have a continuing duty to regulate the activity covered by this incidental take statement. If the Refuges fail to assume and implement the terms and conditions of the incidental take statement, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Refuges must report the progress of the action and its impact on the species to the FWS as specified in the incidental take statement. [50 CFR §402.14(i)(3)].

Sections 7(b)(4) and 7(o)(2) of the Act generally do not apply to listed plant species. However, limited protection of listed plants from take is provided to the extent that the Act prohibits the

removal and reduction to possession of Federally listed endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State or in the course of any violation of a State criminal trespass law.

AMOUNT OR EXTENT OF TAKE

We anticipate that Yaqui topminnow, Yaqui chub, Yaqui catfish, beautiful shiner, and Chiricahua leopard frog will be incidentally taken due to the effects of prescribed fire (harm and mortality); capture, relocation, and repatriation within managed ponds (harass and harm); non-fire applications (harm and mortality); wildfire suppression (harm and mortality); and post-fire rehabilitation (harm), but not to the extent that any populations will be lost.

We anticipate incidental take of Yaqui topminnow, Yaqui chub, Yaqui catfish, beautiful shiner, and Chiricahua leopard frog will be difficult to detect for the following reason(s): early life stages of these species have small body sizes; losses may be masked by seasonal fluctuations in numbers or other causes (e.g., oxygen depletions for aquatic species, disease); dead fish, tadpoles, and frogs are easily scavenged; and the species occurs in habitats that makes detection difficult, and therefore finding a dead or impaired specimen is unlikely.

However, incidental take will be considered exceeded if:

- Within San Bernardino NWR:
    - An entire population of fish or Chiricahua leopard frogs within one managed pond is extirpated due to incidental take resulting from the proposed action, or
    - An entire population of fish, frogs, and/or tadpoles within Black Draw is extirpated due to incidental take resulting from the proposed action, or

- Within Leslie Creek NWR
    - The entire population of fish or Chiricahua leopard frogs within Leslie Creek is extirpated due to incidental take resulting from the proposed action.

EFFECT OF THE TAKE

In the accompanying biological opinion, we determined that this level of anticipated take is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS

We believe the following reasonable and prudent measures are necessary and appropriate to minimize incidental take of the Yaqui topminnow, Yaqui chub, Yaqui catfish, beautiful shiner, and Chiricahua leopard frog. In order to be exempt from the prohibitions of section 9 of the Act, the Refuges must comply with the following terms and conditions, which implement the reasonable and prudent measures and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. The Refuges shall follow our protocols when transporting Chiricahua leopard frogs.

    a. The Refuges shall follow the General Guidelines for Transportation of Leopard Frog Life Stages included in Appendix A when transporting Chiricahua leopard frogs.

2. The Refuges shall comply with the Region's Pesticide Use Guidelines for fish and frogs (White 2004).

3. The Refuges shall develop a contingency plan for the salvage of Río Yaqui fishes and Chiricahua leopard frogs from Leslie Creek in the event of a post-fire flood event.

4. The Refuges shall monitor incidental take resulting from the proposed action and report to us the findings of that monitoring.

    a. The Refuges shall monitor incidental take of individuals of the species and loss of its habitat that causes harm. You should coordinate with us on the development of a monitoring plan.

    b. The Refuges shall submit an annual monitoring report to us by March 1 of each year beginning the March following the year fire management activities commence. These reports shall briefly document for the previous calendar year the effectiveness of the terms and conditions and locations of listed species observed, and, if any are found dead, suspected cause of mortality. The report shall also summarize tasks accomplished under the proposed minimization measures and terms and conditions. The report shall make recommendations for modifying or refining these terms and conditions to enhance listed species protection or reduce needless hardship on the Refuges.

Review requirement: The reasonable and prudent measures, with their implementing terms and conditions, are designed to minimize incidental take that might otherwise result from the proposed action. If, during the course of the action, the level of incidental take is exceeded, such incidental take would represent new information requiring review of the reasonable and prudent measures provided. The Refuges must immediately provide an explanation of the causes of the taking and review with us the need for possible modification of the reasonable and prudent measures.

Disposition of Dead or Injured Listed Species

Disposition of dead, injured, or sick listed species shall be in compliance with the Refuge's section 10(a)(1)(A) permit issued by the Regional Office for collection and salvage of listed species.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1) We recommend the Refuges strictly monitor the effects of chemical herbicide treatments on Chiricahua leopard frog and Huachuca water umbel populations in addition to Río Yaqui fishes. By researching and monitoring these effects, the Refuges can provide valuable information regarding the impacts of herbicides on these species and assist in their recovery.

2) The Refuges should refrain from spraying herbicides on or near Huachuca water umbel.

REINITIATION NOTICE

This concludes formal consultation on the San Bernardino and Leslie Canyon NWR's FMP. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

We appreciate the Refuges' efforts to identify and minimize effects to listed species from this project. For further information please contact Marit Alanen at (520) 670-6150 (x234) or Jim Rorabaugh at (602) 242-0210 (x238). Please refer to the consultation number, 02-21-05-F-0495, in future correspondence concerning this project.

/s/ Steven L. Spangle

cc: Regional Director, Fish and Wildlife Service, Albuquerque, NM (ARD-ES)
Assistant Field Supervisor, Fish and Wildlife Service, Tucson, AZ

Habitat Branch, Arizona Game and Fish Department, Phoenix, AZ (Attn: Bob Broscheid)
Regional Supervisor, Arizona Game and Fish Dept., Tucson, AZ (Attn: Joan Scott)

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LITERATURE CITED

Arizona Department of Water Resources. 1994. Upper San Pedro River case study. Pages 147-208 In Arizona riparian protection program, legislative report, July 1994. Arizona Department of Water Resources, Phoenix, Arizona.

Bahre, C.J. 1991. A legacy of change: Historic human impact on vegetation of the Arizona borderlands. University of Arizona Press, Tucson, Arizona. 231pp.

Blanchard, C.L., and M. Stromberg. 1987. Acidic precipitation in southeastern Arizona: sulfate, nitrate, and trace-metal deposition. Atmospheric Environment 21(11):2375-2381.

Bozek, M.A. and M.K. Young. 1994. Fish mortality resulting from delayed effects of fire in the Greater Yellowstone Ecosystem. Great Basin Naturalist 54:91-95.

Bradley, G.A., P.C. Rosen, M.J. Sredl, T.R. Jones, and J.E. Longcore. 2002. Chytridomycosis in native Arizona frogs. Journal of Wildlife Diseases 38(1):206-212.

Bryan, K. 1925. Date of channel trenching (arroyo cutting) in the arid southwest. Science 62:338-344.

Campoy-Favela, J., A. Varela-Romero, and L. Juarez-Romero. 1989. Observaciones sobre la ictiofauna native de la cuenca del Rio Yaqui, Sonora, Mexico. Ecologica 1:1-13.

Carey, C., N. Cohen, and L. Rollins-Smith. 1999. Amphibian declines: an immunological perspective. Developmental and Comparative Immunology 23:459-472.

_____, W.R. Heyer, J. Wilkinson, R.A. Alford, J.W. Arntzen, T. Halliday, L. Hungerford, K.R. Lips, E.M. Middleton, S.A. Orchard, and A.S. Rand. 2001. Amphibian declines and environmental change: use of remote sensing data to identify environmental correlates. Conservation Biology 15(4):903-913.

_____, A.P. Pessier, and A.D. Peace. 2003. Pathogens, infectious disease, and immune defense. Pages 127-136 *in* R.D. Semlitsch, editor. Amphibian Conservation. Smithsonian Books, Washington, D.C.

Carr, J. A., A. Gentles, E. E. Smith, W. L. Goleman, L. J. Urquidi, K. Thuett, R. J. Kendall, J. P. Giesy, T. S. Gross, K. R. Solomon, and G. Van Der Kraak. 2003. Response of larval *Xenopus laevis* to atrazine: assessment of growth, metamorphosis, and gonadal and laryngeal morphology. Environmental Toxicology and Chemistry 22:396-405.

Clarkson, R.W., and J.C. Rorabaugh. 1989. Status of leopard frogs (*Rana pipiens* Complex) in Arizona and southeastern California. Southwestern Naturalist 34(4):531-538.

Collins, J.P., J.L. Brunner, V. Miera, M.J. Parris, D.M. Schock, and A. Storfer. 2003. Ecology and evolution of infectious disease. Pages 137-151 *in* R.D. Semlitsch, editor. Amphibian Conservation. Smithsonian Books, Washington, D.C.

Davidson, C., S. H. Bradley, and M. R. Jennings. 2002. Spatial tests of the pesticide drift, habitat destruction, UV-B, and climate change hypotheses for California amphibian declines. Conservation Biology 16(6):1588-1601.

Deacon, J.E., and W.L. Minckley. 1974. Desert fishes. Pages 385-488 *in* G.W. Brown, editor. Desert Biology, Volume II. Academic Press, New York, New York.

DeByle, N.V. and P.E. Packer. 1972. Pages 296-307 *in* Plant nutrient and soil losses in overland flow from burned forest clearcuts. National Symposium on Watersheds in Transition.

Degenhardt, W.G., C.W. Painter, and A.H. Price. 1996. Amphibians and reptiles of New Mexico. University of New Mexico Press, Albuquerque, New Mexico.

DeMarais, B.D., and W.L. Minckley. 1991. Genetics and morphology of Yaqui chub, an endangered cyprinid fish subject to recovery efforts. Final Report. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

_____, and _____. 1993. Genetics and morhpology of Yaqui chub, *Gila purpurea*, an endangered cyprinid fish subject to recovery efforts. Biological Conservation 66:195- 206.

Dobyns, H.F. 1981. From fire to flood: historic human destruction of Sonoran Desert riverine oases. Ballena Press, Socorro, New Mexico. 222pp.

Dunham, J.B., M.K. Young, R.E. Gresswell, and B.E. Rieman. 2003. Effects of fire on fish populations: landscape perspectives on persistence of native fishes and nonnative fish invasions. Forest Ecology and Management 178(1-2):183-196.

Fernandez, P.J., and J.T. Bagnara. 1995. Recent changes in leopard frog distribution in the White Mountains of east central Arizona. Page 4 *in* abstracts of the First Annual Meeting of the Southwestern Working Group of the Declining Amphibian Populations Task Force, Phoenix, Arizona.

_____, and P.C. Rosen. 1996. Effects of the introduced crayfish *Oronectes virilis* on the native aquatic herpetofauna in Arizona. Report to the Arizona Game and Fish Department, Heritage Program, IIPAM Project No. I94054.

_____, and _____. 1998. Effects of introduced crayfish on the Chiricahua leopard frog and its stream habitat in the White Mountains, Arizona. Page 5 *in* abstracts of the Fourth Annual Meeting of the Declining Amphibian Populations Task Force, Phoenix, Arizona.

Ffolliott, P.F., L.F. DBano, M.B. Baker, Jr., D.G. Neary, and K.N. Brooks. 2004. Hydrology and Impacts of Disturbance on Hydrologic Function. Pages 51-76 *in* Baker, M.B., P.F.

Ffolliott, L.F. DBano, and M.B. Baker, Jr., D.G. Neary, and K.N. Brooks, editors. 2004. Riparian Areas of the Southwestern United States, Hydrology, Ecology, and Management. CRC Press LLC. Boca Raton, FL.

Furniss, M.J., S.A. Flanagan, and B. McFadinches. 2000. Hydrologically-connected roads: an indicator of the influence of roads on chronic sedimentation, surface water hydrology, and exposure to toxic chemicals. July 2000. Stream Notes. USDA Forest Service Stream Systems Technology Center. Fort Collins, CO.

Galat, D.L., and B. Robertson. 1992. Response of endangered Poeciliopsis occidentalis sonoriensis in the Rio Yaqui drainage, Arizona, to introduced Gambusia affinis. Environmental Biology of Fishes 33(3):249-264.

Gehlbach, F. R. 1981. Mountain islands and desert seas: A natural history of the U.S.-Mexican borderlands. Texas A&M University Press, College Station, Texas.

Gresswell, R.E. 1999. Fire and Aquatic Ecosystems in Forested Biomes of North America. Transactions of the American Fisheries Society 128:193-221.

Haas, S.K, and R.J. Frye. 1997. Hydrology and water quality effects on *Lilaeopsis schafffneriana* ssp. *recurva.* Report to Arizona Dept. of Agriculture and Fort Huachuca.

Hahman, W. R. 1979. Geothermal reservoir site evaluation in Arizona. Bureau of Geology and Mineral Technology, Geological Survey Branch, Geothermal Group, Tucson, Arizona.

Hale, S.F., and J.L. Jarchow. 1988. The status of the Tarahumara frog (*Rana tarahumarae*) in the United States and Mexico: part II. Report to the Arizona Game and Fish Department, Phoenix, Arizona, and the Office of Endangered Species, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

_____, P.C. Rosen, J.L. Jarchow, and G.A. Bradley. *In press.* Effects of chytrid fungus on the Tarahumara frog (*Rana tarahumarae*) in Arizona and Sonora, Mexico. *In* Proceedings of Biodiversity and Management of the Madrean Archipelago II and 5th Conference on Research and Resource Management in the Southwestern Deserts, Tucson, Arizona.

Halliday, T.R. 1998. A declining amphibian conundrum. Nature 394:418-419.

Hastings, J.R., and R.M. Turner. 1980. The changing mile. University of Arizona Press, Tucson, Arizona. 327pp.

Hayes, T. 2004. There is no denying this: defusing the confusion about atrazine. BioScience 54(12):1138-1149.

_____, K. Haston, M. Tsui, A. Hoang, C. Haeffle, and A. Vonk. 2002. Atrazine-induced hermaphroditism at 0.1 ppb in American leopard frogs (*Rana pipiens*): laboratory and field evidence. Environmental Health Perspectives 11(4):568-576.

Haynes, L., and S. Schuetze. 1997. A sampler of Arizona's threatened and endangered wildlife. A Cooperative Project between Arizona Game and Fish Department and Arizona Department of Agriculture.

Hendrickson, D.A., W.L. Minckley, R.R. Miller, D.J. Siebert, and P.H. Minckley. 1980. Fishes of the Rio Yaqui basin, Mexico and United States. Journal of the Arizona-Nevada Academy of Science 15(3): 65-106.

_____, and W.L. Minckley. 1984. Cienegas - vanishing climax communities of the American southwest. Desert Plants 6(3):131-175.

Hereford, R. 1993. Geomorphic evolution of the San Pedro River channel since 1900 in the San Pedro Riparian National Conservation Area, southeast Arizona. US Geological Survey, Open File Report 92-339. 71pp.

Humphrey, R. R. 1986. Ninety years and 535 miles: Vegetation changes along the Mexican border. University of New Mexico Press, Albuquerque, New Mexico.

Jennings, R.D. 1995. Investigations of recently viable leopard frog populations in New Mexico: *Rana chiricahuensis* and *Rana yavapaiensis*. New Mexico Department of Game and Fish, Santa Fe, New Mexico.

Jones, R.D., D.G. Boltz, G. Carty, L. R. Kaeding, D. L. Mahony, and T. Olliff. 1993. Fishery and aquatic management program in Yellowstone National Park. U.S. Fish and Wildlife Service, Yellowstone National Park, Wyoming.

Juarez-Romero, L., A. Varela-Romero, and J.R. Campoy-Favela. 1988. Observaciones preliminares sobre la ictiofauna del Rio Matape, Sonora, Mexico. Memorias IX del Congreso Nacional de Zoologia. Villahermosa, Tabasco. October 13-16, 1987 II:27-33.

Karle, T.J. 2000. Wildfire Ecology, Fire and Water, Hydrology Study. Santa Monica Mountains N.P.A. Parks as Classrooms. Available at http://www.nps.gov/samo/educate/Fire%20Website/stud9.htm.

La Point, T.W., M. Parker, C.A. Brewer, and M. Crossey. 1983. Impact of fire on recreation stream water quality and spawning habitat. Final Report (Cooperative Agreement 28-C2-222) of University of Wyoming, Department of Zoology and Physiology to U.S. Forest Service, Laramie, Wyoming.

Lawrence, D.E. and G.W. Minshall. 1994. Short-and long-term changes in riparian zone vegetation and stream macroinvertebrate community structure. Pages 171-184 *in* D.G. Despain, editor. Plants and their environments: proceedings of the first biennial scientific conference on the Greater Yellowstone Ecosystem. U.S. National Park Service, Natural Resources Publication Office, Technical Report NPS/NRYELL/NRTR-93/XX, Denver, Colorado.

Lips, K.R. 1999. Mass mortality and population declines of anurans at an upland site in western Panama. Conservation Biology 13:117-125.

Lotspeich, F.B., E.W. Mueller, P.J. Frey. 1970. Effects of large scale forest fire on water quality in interior Alaska. Federal Water Pollution control Administration, Alaska Water Laboratory, College, Alaska.

Martin, S.C. 1975. Ecology and management of southwestern semidesert grass-shrub ranges: the status of our knowledge. U.S. Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado. 39pp.

Meffe, G.K., D.A. Hendrickson, and W.L. Minckley. 1983. Factors resulting in decline of the endangered Sonoran topminnow, *Poeciliopsis occidentalis* (Antheriniformes: Poeciliidae) in the United States. Biological Conservation 25:135-159.

_____, and F.F. Snelson. 1989. An ecological overview of poeciliid fishes. Pages 13-31 *in* G.K. Meffe and F.F. Snelson, Jr., editors. Ecology and Evolution of Livebearing Fishes. Prentice Hall, Englewood Cliffs, NJ.

Mihuc, T.B., G.W. Minshall, and C.T. Robinson. 1996. Response of benthic macroinvertebrate populations in Cache Creek, Yellowstone National Park, to the 1988 wildfires. Pages 83-94 *in* J. Greenlee, editor. Proceedings of the second biennial conference on the Greater Yellowstone Ecosystem: the ecological implications of fire in Greater Yellowstone. International Association of Wildland Fire, Fairfield, Washington.

Miller, R. R. 1940. Original field notes on a collection of fishes from Rio San Miguel, Sonora, Mexico (Rio Sonora drainage), including Yaqui catfish. University of Michigan Museum of Zoology, Ann Arbor, Michigan.

_____. 1976. An evaluation of S. E. Meek' s contributions to Mexican ichthyology. Fieldiana Zoology 69(1):1-31.

_____. 1978. Composition and derivation of the native fish fauna of the Chihuahuan Desert region, US and Mexico. Pages 365-382 *in* R. H. Wauer and D. H. Riskind, editors. Transactions of the Symposium on Biological Resources of the Chihuahuan Desert Region, United States and Mexico. USDI National Park Service, Trans. -Proc. Ser. 3.

Minckley, W.L. 1973. Fishes of Arizona. Arizona Game and Fish Department, Phoenix, Arizona.

_____, J.N. Rinne, and J.E. Johnson. 1977. Status of the Gila topminnow and its coocurence with mosquitofish. Research Paper RM-198, USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado.

Minshall, G.W. 2003. Responses of stream macroinvertebrates to fire. Forest Ecology and Management 178(1-2):155-161.

_____, D.A. Andrews, J.T. Brock, C.T. Robinson, and D.E. Lawrence. 1990. Changes in wild trout habitat following forest fire. Pages 174-177 *in* F. Richardson and R.H. Hamre, editors. Wild Trout IV: proceedings of the symposium. Trout Unlimited, Arlington, VA.

_____, J.T. Brock, and J.D. Varley. 1989. Wildfires and Yellowstone's stream ecosystems. BioScience 39:707-715.

_____, C.T. Robinson, and D.E. Lawrence. 1997. Postfire responses of lotic ecosystems in Yellowstone National Park, U.S.A. Canadian Journal of Fisheries and Aquatic Sciences 54:2509-2525.

_____, C.T. Robinson, T.V. Royer, and S.R. Rushforth. 1995. Benthic community structure in two adjacent streams in Yellowstone National Park five years after the 1988 wildfire. Great Basin Natural 55:193-200.

Norris, L.A., H.W. Lorz, and S.V. Gregory. 1991. Forest Chemicals. American Fisheries Society Special Publication 19:207-296.

Novak, M.A. and R.G. White. 1990. Impact of fire and flood on the trout population of Beaver Creek, upper Missouri basin, Montana. Pages 120-127 *in* F. Richardson and R.H. Hamre, editors. Wild Trout IV: proceedings of the symposium. Trout Unlimited, Arlington, Virginia.

Painter, C.W. 2000. Status of listed and category herpetofauna. Report to US Fish and Wildlife Service, Albuquerque, New Mexico. Completion report for E-31/1-5.

Parris, M.J., and D.R. Baud. 2004. Interactive effects of a heavy metal and chytridiomycosis on gray treefrog larvae (*Hyla chrysoscelis*). Copeia 2004(2):344-350

Platz, J.E., and J.S. Mecham. 1979. *Rana chiricahuensis*, a new species of leopard frog (*Rana pipiens* Complex) from Arizona. Copeia 1979(3):383-390.

_____, and _____. 1984. *Rana chiricahuensis*. Catalogue of American Amphibians and Reptiles 347.1.

Propst, D.L., J.A. Stefferud, and P.R. Turner. 1992. Conservation and status of Gila trout, *Oncorhynchus gilae*. Southwestern Naturalist 37:117-125.

Richards, C., and G.W. Minshall. 1992. Spatial and temporal trends in stream macroinvertebrate communities: the influence of catchment disturbance. Hydrobiologia 241:173-184.

Rieman, B.E., D. Lee, G. Chandler, and D. Meyers. 1997. Does wildfire threaten extinction for salmonids: responses of redband trout and bull trout following recent large fires on the Boise National Forest. Pages 47-57 *in* J. Greenlee, editor. Proceedings of the symposium on fire effects on threatened and endangered species and their habitats. International Association of Wildland Fire, Fairfield, Virginia.

Rinne, J.N. 1975. Changes in minnow populations in a small desert stream resulting from natural and artificially induced factors. Southwest Naturalist 202(2):185-195.

_____. 1996. Short-term effects of wildfire on fishes and aquatic macroinvertebrates in the southwestern United States. North American Journal of Fisheries Management 16:653-658.

Robinson, C.T., G.W. Minshall, and S.R. Rushforth. 1994. The effects of the 1988 wildfires on diatom assemblages in streams of Yellowstone National Park. Pages 247-257 *in* D.G. Despain, editor. Plants and their environments: proceedings of the first biennial scientific conference on the Greater Yellowstone Ecosystem. U.S. National Park Service, Natural Resources Publication Office, Technical Report NPS/NRYELL/NRTR-93/XX, Denver, Colorado.

Roby, K.B. 1989. Watershed response and recovery from the Will fire: ten years of observation. U.S. Forest Service General Technical Report PSW-109:131-136.

_____, and D.L. Azuma. 1995. Changes in a reach of a Northern California stream following fire. Environmental Management 19(4):591-600.

Rosgen, D. 1996. Applied river morphology. Wildland Hydrology, Inc. Pagosa Springs, Colorado.

Rosen, P.C. 2002. Population losses, die-offs, and chytrid fungal disease in leopard frogs and the bullfrog in the arid Southwest. Report to the Arizona Game and Fish Department, Phoenix, Arizona. Heritage Grant IIPAM I99016.

_____, C.R. Schwalbe, D.A. Parizek, P.A. Holm, and C.H. Lowe. 1994. Introduced aquatic vertebrates in the Chiricahua region: effects on declining native ranid frogs. Pages 251-261 *in* L.F. DeBano, G.J. Gottfried, R.H. Hamre, C.B. Edminster, P.F. Ffolliott, and A. Ortega-Rubio, technical coordinators. Biodiversity and management of the Madrean Archipelago. USDA Forest Service, General Technical Report RM-GTR-264.

_____, C.R. Schwalbe, and S.S. Sartorius. 1996. Decline of the Chiricahua leopard frog in Arizona mediated by introduced species. Report to Heritage program, Arizona Game and Fish Department, Phoenix, Arizona. IIPAM Project No. I92052.

Saucedo Monarque, E. 1990. Proyecto: Prospeccion de plantas raras en el Norte de Sonora. Centro Ecologico de Sonora, Subdireccion de Investigacion, Area de Ecologia Terrestre, Hermosillo, Sonora, Mexico. 65pp.

Schoenherr, A. A. 1973. Life history of the topminnow *Poeciliopsis occidentalis* (Baird & Girard) in Arizona and an analysis of its interaction with the mosquitofish *Gambusia affinis* (Baird & Girard). Dissertation, Arizona State University, Tempe, Arizona.

Schurbon, J. M., and J. E. Fauth. 2003. Effects of prescribed burning on amphibian diversity in a southeastern U.S. National Forest. Conservation Biology 17(5):1338-1349.

Shafer, C.L. 1990. Nature reserves, island theory and conservation practice. Smithsonian Institution Press, Washington, D.C. 189pp.

Sheridan, T.E. 1986. Los Tucsonenses: the Mexican community in Tucson, 1854-1941. University of Arizona Press, Tucson, Arizona. 327pp.

Snyder, J., T. Maret, and J.P. Collins. 1996. Exotic species and the distribution of native amphibians in the San Rafael Valley, AZ. Page 6 *in* abstracts of the Second Annual Meeting of the Southwestern United States Working Group of the Declining Amphibian Populations Task Force, Tucson, Arizona.

Sparling, D.W. 2003. A review of the role of contaminants in Amphibian declines. Pages 1099-1128 *in* D.J. Hoffman, B.A. Rattner, G.A. Burton, Jr., and J. Cairns, Jr., editors. Handbook of Ecotoxicology, Second Edition. CRC Press LLC, Lewis Publishers, Boca Raton, Florida.

Spencer, C.N. and F.R. Hauer. 1991. Phosphorus and nitrogen dynamics in streams during a wildfire. Journal of the North American Benthological Society 10(1):24-30.

_____, K.O. Gabel, and F.R. Hauer. 2003. Wildfire effects on stream food webs and nutrient dynamics in Glacier National Park, USA. Forest Ecology and Management 178:141-153.

Sredl, M.J., and J.M. Howland. 1994. Conservation and management of madrean populations of the Chiricahua leopard frog, *Rana chiricahuensis*. Arizona Game and Fish Department, Nongame Branch, Phoenix, Arizona.

_____, J.M. Howland, J.E. Wallace, and L.S. Saylor. 1997. Status and distribution of Arizona's native ranid frogs. Pages 45-101 *in* M.J. Sredl, editor. Ranid frog conservation and management. Arizona Game and Fish Department, Nongame and Endangered Wildlife Program, Technical Report 121.

_____, and R.D. Jennings. 2005. *Rana chiricahuensis*: Platz and Mecham, 1979, Chiricahua leopard frogs. Pages 546-549 *in* M.J. Lanoo, editor. Amphibian Declines, The Conservation Status of United States Species. University of California Press, Berkeley, California.

Stromberg, J.C., and M.K. Chew. 1997. Herbaceous exotics in Arizona's riparian ecosytems. Desert Plants 1997(2):11-17.

Sublette, J.E., M.D. Hatch, and M. Sublette. 1990. The fishes of New Mexico. University of New Mexico Press, Albuquerque, New Mexico. 393 pp.

U.S. Fish and Wildlife Service. 1984. Final rule to determine the Yaqui chub to be an endangered species with critical habitat, and to determine the beautiful shiner and the Yaqui catfish to be threatened species with critical habitat. Federal Register 49(171):34490-34497.

_____. 1987. Management plan for the San Bernardino National Wildlife Refuge, Arizona. U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

_____. 1995. Fishes of the Rio Yaqui Recovery Plan. U.S. Fish and Wildlife Service, Albuquerque, New Mexico. 48 pp.

_____. 2004a. Unpublished data. Research Project 22523-0005. Fish Health Surveys and Relative Abundance at San Bernardino and Leslie Canyon NWRs. Douglas, Arizona.

_____. 2004b. San Bernardino National Wildlife Refuge, Leslie Canyon National Wildlife Refuge, Annual Narrative Report, Calendar Year 2003. Douglas, Arizona.

U.S. Forest Service. 2004. Biological assessment on eleven land and resource management plans, USDA Forest Service, Southwestern Region.

Wagoner, J.J. 1960. Overstocking the ranges in southern Arizona during the 1870's and 1880's. Arizonian 2:23-27.

Wallace, J.E. 2003. Status assessment of lowland leopard frogs in mountain canyons of Coronado National Forest-Santa Catalina Ranger District. Report to the Coronado National Forest, Purchase Order #43-8197-3-0058.

Warren, P.L., L.S. Anderson, and P.B. Shafroth. 1989. Population studies of sensitive plants of the Huachuca and Patagonia Mountains, Arizona. Unpublished report. Coronado National Forest, Tucson, Arizona. 99 pp.

_____, D.F. Gori, L.S. Anderson, and B. Gebow. 1991. Status report for Lilaeopsis schaffneriana ssp. recurva. U.S. Fish and Wildlife Service, Arizona Ecological Services State Office, Phoenix, Arizona. 30 pp.

_____, and F.R. Reichenbacher. 1991. Sensitive plant survey of Ft. Huachuca, Arizona. Unpublished report for the U.S. Army, Ft. Huachuca, Arizona.

Webb, R.H., and J.L. Betancourt. 1992. Climatic variability and flood frequency of the Santa Cruz River, Pima County, Arizona. U.S. Geological Survey Water-supply Paper 2379.

White, J.A. 2004. Recommended protection measures for pesticide applications in Region 2 of the U.S. Fish and Wildlife Service. U.S. Fish and Wildlife Service, Austin, Texas.

Wilcox, B.A., and D. Murphy. 1985. Conservation strategy: the effects of fragmentation on extinction. American Naturalist 125: 879-887.

TABLES AND FIGURES

Table 1. Recent section 7 consultations on proposed actions affecting fishes of the Yaqui Basin. All were non-jeopardy opinions.

Date	Agency	Project	File Number
June 10, 2005	Forest Service (FS)	Programmatic Biological and Conference Opinion on the Continued Implementation of the Land and Resource Management Plans for the Eleven National Forests and National Grasslands of the Southwest Region	02-22-03-F-366
September 3, 2004	Bureau of Land Management (BLM)	Arizona Statewide Land Use Plan Amendment for Fire, Fuels, and Air Quality Management	02-21-03-F-0210
July 15, 2003	Fish and Wildlife Service (FWS)	Tule Spring Restoration	02-21-03-F-0261
October 24, 2002	FS	Reinitiation of Biological Opinion 02-21-98-F-399; Continuation of Livestock Grazing on the Coronado National Forest	02-21-98-F-399-R1
March 22, 2001	FS	Amendment to the November 16, 1999, biological opinion (BO) (02-21-98-F-286) on the Johnson Peak Fire Management Plan	02-21-98-F-286
July 29, 1999	FS	On-going and Long-term Grazing on the Coronado National Forest	02-21-98-F-399
February 4, 1999	FS	West Turkey Creek Native Fish Habitat Renovation Project	02-21-99-F-130
December 11, 1998	Environmental Protection Agency	Approval of the 1996 modifications to the Arizona Water Quality Standards	02-21-92-F-550 and 02-21-96-F-187
November 3, 1997	FWS	Reintroduction of the Yaqui catfish and Yaqui sucker on the San Bernardino NWR	02-21-97-F-143
May 29, 1997	FWS	San Bernardino NWR Asian Tapeworm Eradication	02-21-97-F-051
January 30, 1991	FWS	Replacement of an artesian well at Cienega Spring on the San Bernardino NWR	02-21-91-F-059

Figure 1. Fire Management Unit (FMU) boundaries on San Bernardino National Wildlife Refuge.

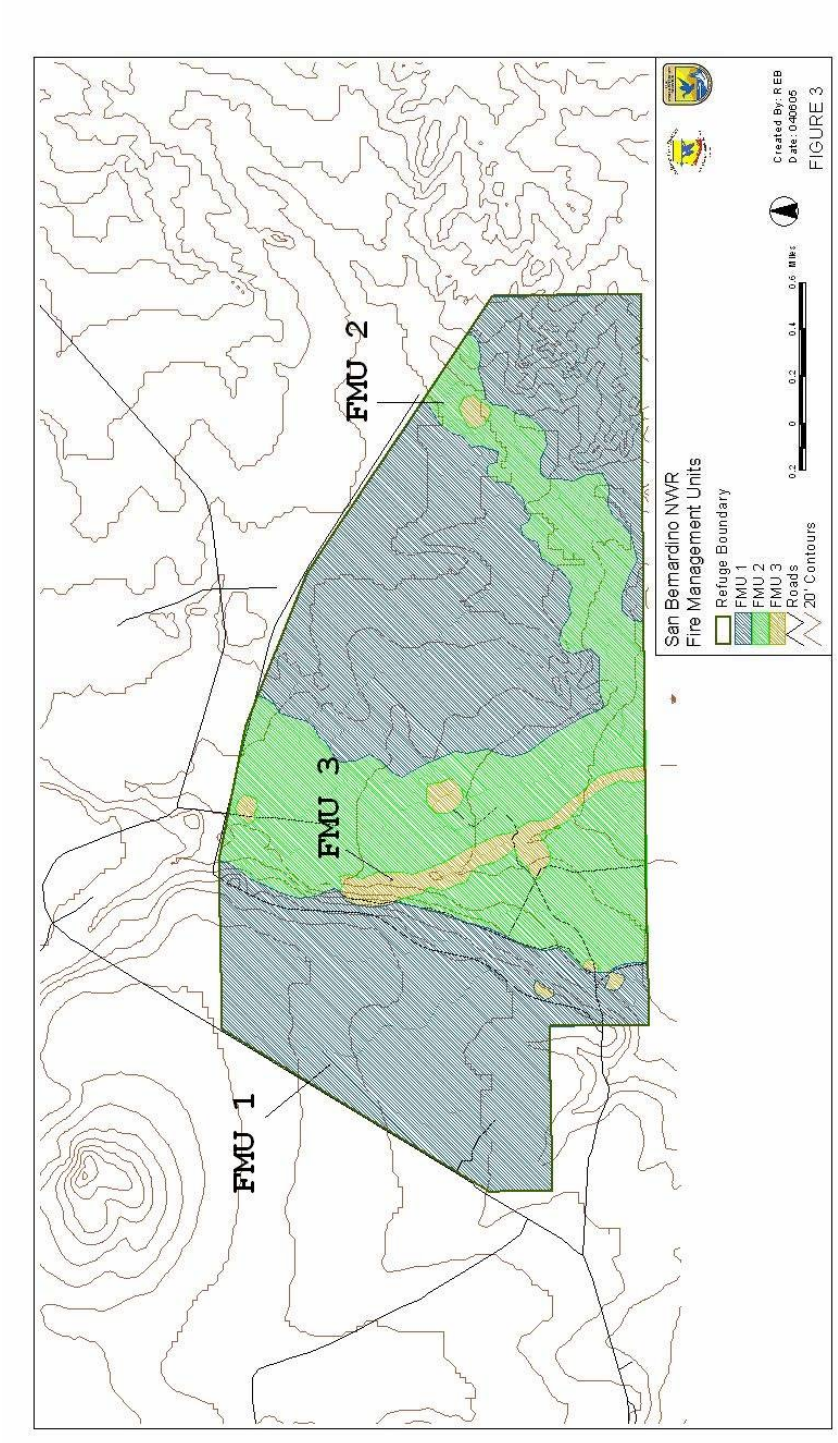
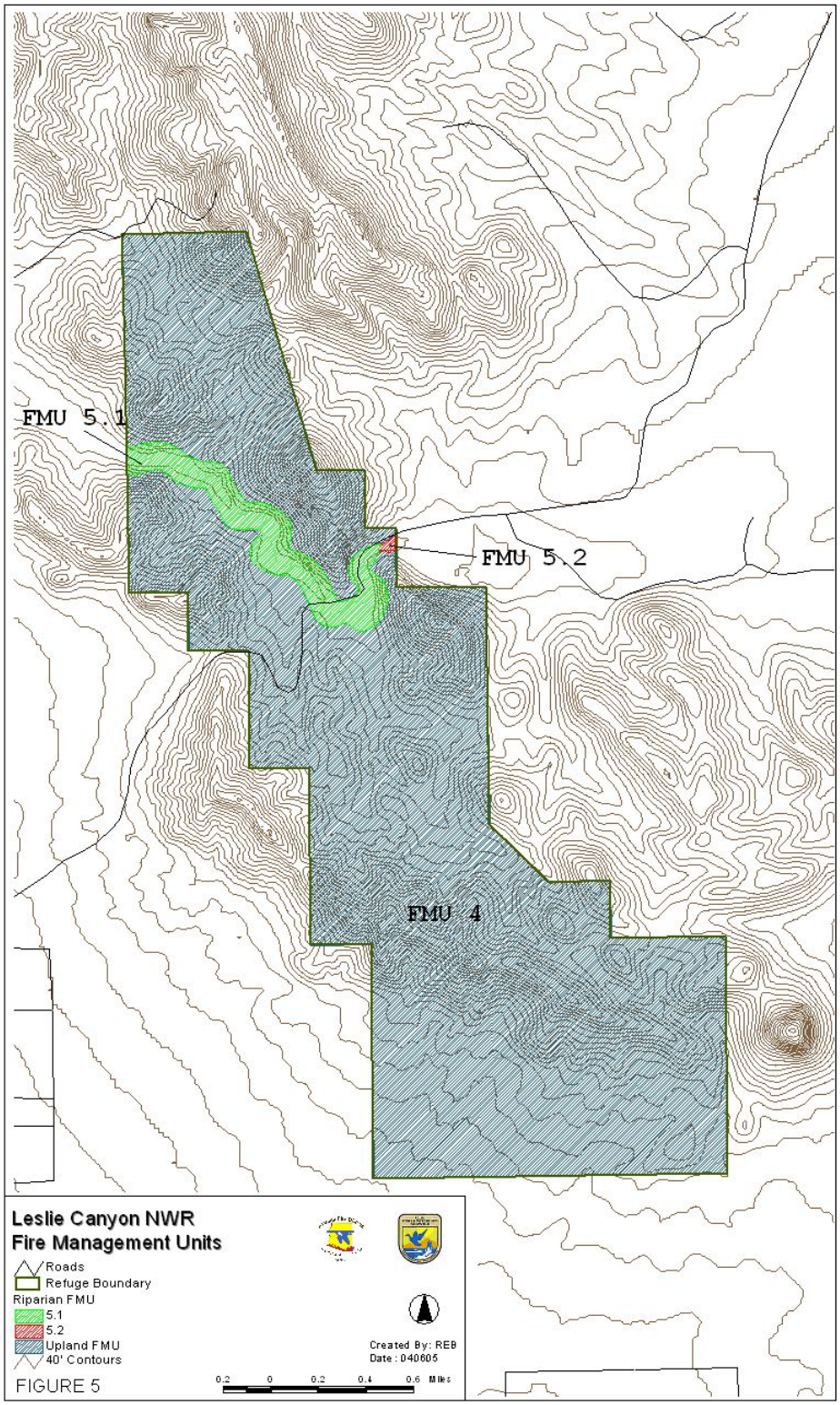


Figure 2. Fire Management Unit (FMU) boundaries on Leslie Canyon National Wildlife Refuge.



APPENDIX A

GENERAL GUIDELINES FOR TRANSPORTATION OF LEOPARD FROG LIFE STAGES

- Transportation
  - General Container Information
    - Use only plastic containers, no metal or glass.
    - Containers should be water tight when tipped upside down.
    - Do not use bags more than once. Use only new, rinsed bags.
    - Carry 1 or 2 extra containers filled with water in case of an emergency (i.e. leak).
  - Type of Containers per animal size
    - Larvae at any stage, ship well in 11" x 10.5" (1 gallon self closing bags (e.g. Ziplocs®) or in aquarium grade plastic bags sealed with a rubber band. Aquarium grade bags can be inflated and sealed with rubber bands to prevent collapsing. Double bagging should be considered for trips longer than 4 hours or when driving on rough roads.
    - Larvae may also be transported in hard plastic buckets or containers that have tight fitting lids.
    - GladWare® is highly recommended for transportation of metamorphs, juveniles, and adults. They keep them from being crushed and they are reusable.
  - Preparing Containers
    - Thoroughly rinse all shipping containers with water. Do not use any type of detergent or soap to clean the containers.
    - The GladWare® also needs holes drilled in the top. A standard hole punch works well, approximately 16 holes. Drill from the inside out so that no sharp edges protrude into the animal holding space.
    - If desired, mark each bag with identification of eventual destination and the number of animals in the container.
  - Stocking densities
    - Per gallon bag for short shipments.
      - Eggs: 1 mass per bag, minimize disturbance and division of mass
      - Larvae under ½": 25 per bag
      - Larvae 1" - 1 ½": 15 per bag
      - Larvae over 1 ½": 10 per bag
      - Recently metamorphosed frogs: 5 per container or bag
    - Avoid overcrowding
  - Water
    - Water put in the bags must be chlorine and chloramine free. Dechlorinating chemicals can be used to immediately remove chlorine.
    - Stream or pond water from which the animals originated can be used. Avoid capturing aquatic invertebrates or organic debris.
    - Other alternatives are bottled drinking water or tap water left uncovered for 24 or more hours.

- For larvae, fill bags by approximately 75 percent or greater volume water to avoid excessive sloshing.
- For metamorphs, juveniles, or adults place 20 ml of water with a leaf of romaine or iceberg lettuce for hiding. If transporting from the wild, use algae or leaves instead.
- Shipping
    - Blow out bags with a breath or an oxygen cylinder to prevent collapse during shipping. Allow a little space within the bag to allow for expansion with elevation changes.
    - Foam or plastic insulated ice chests work well for protecting bags from temperature extremes and accidental damage. Foam boxes that fit within a cardboard box are commercially available from tropical fish dealers.
    - Use towels, newspapers or bags blown full of air to fill in empty spaces between bags in the shipping container.
    - Battery operated air pumps are useful in aerating buckets of animals during transport.

o Temperature
- Optimal shipping temperature is a compromise between the captive and anticipated release temperature.
- To keep animals cool in warm weather, place a 1-3 inch layer of cubed ice inside plastic bags on the bottom of an insulated ice chest. Cover the ice with a layer of plastic, then a few layers of towels, newspaper, or cardboard to insulate the animals from the direct cold. It is suggested to place a piece of foam between ice and animals, so if ice melts the animals will float instead of settling in the water.
- A thermometer with a remote sensor inside the container can assist in monitoring the temperature while shipping.
- Alternatively, animals could be moved in open containers if kept inside air-conditioned vehicles capable of maintaining the appropriate desired temperature.
- When tadpoles arrive at the rearing facility, it is important to equalize the temperature of the shipping container and that of the tank into which the animals will be released. This is easily achieved by floating the plastic bag or container in the tank for 15-20 minutes. An aquarium thermometer can be used to ensure that the two containers are within one or two degrees of each other before transferring the animals.